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A Need for Publicity

IN a recent case where a central station decided to purchase electricity from a transmission company, abandoning its plans for expansion of the local steam generating plant, local opinion became aroused against the former in connection with the negotiation of a street-lighting contract, and the central station was covertly attacked for consenting to buy power at a low rate from a so-called "foreign corporation." As a matter of fact, the purchase of energy from the transmission company was a good piece of management and a benefit to the town, but somehow these aspects of the situation were not tactfully put before the public in the local press or in any suitable statement from the company, so far as we can learn. The case is a simple one, so far as this part of it goes, and illustrates the very great importance of taking the public and the local newspapers fully into one's confidence in carrying out comprehensive plans for improved operation.

It is easy to forget that the local public may have a pride in "the old electric light station down at the foot of Hogan's Alley" and may recall from boyhood days visits to the plant under the friendly wing of easy-going Bill Smith, the former manager now gathered to his fathers. In comes a new controlling interest, perhaps with headquarters in a distant city. To the younger blood in the concern it may appear worth not a moment's thought that the old station is an asset in the opinion of the citizens instead of an actual liability when compared with the possible economies of up-to-date distribution from a modern substation. In such a small community, the members of the operating staff are apt to be well known, and the plant by virtue of long years of pretty regular (though costly) service may have become one of the institutions of the place, like the 'New York Dry Goods Emporium" on Main Street, opposite the Imperial (?) Hotel. Now when the new management contracts for the purchase of its entire energy supply from an outside concern (very likely identified with the octopi of "Frenzied Finance" in the minds of many of the public) and proceeds to shut down the old station and rearrange its whole scheme of operation without letting said local public in the scheme of things, it is not so strange that misunderstanding has in some instances crept into the case.

All this friction, or 98 per cent of it certainly, might have been avoided had the advantages of shutting down the old station and buying electricity for local distribution been set forth in an intelligent statement by the new management. Modern substations cost money, and while a bank of three 750-kilovolt-ampere transformers with related wiring and switching equipment does not make a great showing compared with a lot of engines and generators of dubious age and condition, it represents an investment that may very properly be called to the attention of the public, together with the savings in coal which will result from the purchase of electricity in bulk, the reduction in rates in prospect if any, the certainty of better regulation ("Steadier lights," in the vernacular) and the adoption of the latest wrinkles in electrical practice when interesting engineering problems have been solved in the betterment work undertaken.

Power Service After the War

RECENT events in England have had a very marked effect upon the status of electric power service. Electrical men have complained for many years that the national policy toward electric power betrayed a deplorable want of appreciation of the leading place that it was already filling, and was destined to do more thoroughly in the future, in connection with at least all industrial activity. Handicaps, restrictions, local limitations, opposition to overhead lines, objection to facilities for distributing lines, suspicions and jealousies between different electrical authorities—all of these and other difficulties have obstructed the path of whoever sought to secure the larger benefits that cheaper and ampler supply of power could give in practically every department of modern activity.

The importance of the service that electricity has rendered in connection with the great war industries, the movement for economizing in fuel consumption by co-operative action between a number of electricity producers in given areas, and the unanimity of the great body of such producers in favor of schemes for interconnection of their systems—all of these points have greatly weighed with the British Government. The result is that the Board of Trade early in March through one of its parliamentary secretaries declared in no indefinite terms that the old narrow and paroch-

ial policy must be done away with forever. The government recognizes that one of the first and foremost needs of industry now, and especially in the altered industrial conditions, that will be upon us with the dawn of peace, must be power service which shall be cheap, abundant, efficient and readily available. In the middle of March the board carried the matter one step forward by appointing a departmental committee to report what steps should be taken, whether by legislation or otherwise to ensure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their proper development.

If there is one thing that is more certain than others with regard to the very busy reconstruction years that follow upon this lamentable period of holocaust and destruction it is that in the ship-building yards and in factories of every description in many countries industrial electric power will be afforded such a scope for brilliant service as it has never yet had, notwithstanding the greatness of all its past achievements. In all the industrial European countries the possibilities are recognized and appropriate plans are being laid.

"Electricity the Coal-Saver"

SEVERAL of London's central-station companies which naturally under normal conditions located their generating stations on the River Thames in order to avail themselves of the advantage of water-borne coal supplies, now find that what was in peace-time their greatest source of strength is, owing to the war, a real but temporary weakness. Steamers for transporting coal are practically unobtainable and freight rates are six times the pre-war rates from the Tyne to London, $4.50 as compared with $0.75, so that rail-borne coal with added lighterage and handling charges has to be used. One station during the past year came so closely to the end of its fuel supply that a shut-down would have had to come in two or three days had not the authorities come to its assistance. The electric power station of the London Underground Railways (Lots' Road) paid double the pre-war figure for its coal in 1916. It consumes 200,000 tons per annum and the price increased $5 per ton. The president of the Board of Trade has warned users that their coal consumption must be reduced henceforth. This remark has been taken up and replied to by J. B. Braithwaite, chairman of the City of London Electric Light Company who has produced figures to show that electricity producers are by their very occupation fuel-savers. On the basis of 2,000 million kilowatt-hours of electricity he shows that with a coal consumption of 4,000,000 tons per annum there is a saving of 5,000,000 tons per annum as compared with what would happen if users had to turn to other forms of energy instead of electric. Therefore, he argues, to reduce the supply for generating stations would be to "kill the goose that lays the golden egg" and to hit the very people who were daily effecting a great economy of consumption. Surely it is late in the day to have to demonstrate that an expansion of electrical service means the promotion of fuel economy as well as increasing efficiency—efficiency which was never so much needed as under the conditions obtaining in war-time. "Electricity the Coal-Saver" is a necessary and educative slogan.

Electric-Furnace Possibilities

THE application of central-station power to industrial heating processes seems bound to make great advances. An instance of much interest is the baking of cores for use in foundries, which furnishes a most promising field. Baking in gas-fired or coal-fired ovens is pretty much of a haphazard process, with considerable doubt as to the condition of the product when it emerges, since it may have encountered a wide range of variation in temperature, ventilation, rapidity of reaching maximum temperature, etc. Yet these variables have each an effect upon the quality of the product. Unfortunately for this particular industry, not any great quantity of information is available as to the most desirable oven conditions, but these conditions could soon be determined if they were subject to easy and accurate control.

Such control is afforded by the electric oven. Exact and constant temperature maintenance is secured and the oven atmosphere may be regulated as desired. There are no undesirable products of combustion to contend with, and the maximum temperature may be attained slowly or rapidly and then held for a definite time. Such control may be of more importance than fuel cost, as uncertainty of oven conditions means uncertainty of output, and the loss of a small percentage of output will balance the bill for electric power.

We have at previous times called attention to the great advantages of electric heat for japanning and enameling operations. The saving of time in the baking process and the improvement in quality, combined with a large decrease in the percentage of defective material, have made the expenditure for electric power an actual saving in the industries which have adopted this innovation. It is not so evident that the quality of foundry cores should be similarly dependent upon oven conditions, yet this application of electric heat has also been found of commercial advantage.

It seems probable that the advantages of the electric furnace are not limited by any means to high-temperature operations such as steel refining and electrochemical processes, but may on the contrary cover a wide range of low-temperature operations, of which the two above mentioned are but typical examples which have already come within the central-station field.

HAPPENINGS IN THE INDUSTRY

Annual Convention of American Institute Postponed—Impetus to be Given Commercial Electric Vehicles in Chicago—Program for Northwest Convention—Meeting of Electrical Council of Underwriters' Laboratories —Electrical Supply Jobbers' Convention—Miscellaneous News Notes

ANNUAL AMERICAN INSTITUTE MEETING POSTPONED.

Institute Meeting to Be Held in New York City June 27 and 28 to Discuss Papers.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers, held on May 18, information received from various sources indicated that, on account of the national situation, many active members of the Institute who usually attend conventions will not be able to spare the time to attend the scheduled four-day annual convention at Hot Springs, Va. Many of the Institute members have already received commissions in the Engineer Officers' Reserve Corps of the Army, and a large number are, or soon will be, rendering service to the government in various other capacities. The directors therefore voted to cancel the 1917 annual convention.

The directors also voted to hold an Institute meeting in New York, June 27 and 28, for the presentation and discussion of the papers that were to have been presented at the annual convention. Details of the program will appear later.

COMMERCIAL ELECTRICAL TRUCKING TO BE GIVEN IMPETUS IN CHICAGO.

Announcement of New Commonwealth Edison Service Made at Annual Meeting of Chicago Electric Vehicle Section.

An announcement of the greatest importance to the future of the commercial electric vehicle industry was made at the annual meeting of the Chicago branch of the Electric Vehicle Section, National Electric Light Association, which was held at the City Club of Chicago on the evening of May 25. This announcement was made by E. W. Lloyd, general contract agent of the Commonwealth Edison Company, Chicago. Mr. Lloyd said that while Chicago has more electric vehicles of the pleasure type than any other city the development in the electric-truck line has been handicapped by a number of conditions. One of these is an excessive emphasis placed by Americans on speed. The aggressive methods used by the manufacturers of gas automobiles have accounted for the large hold of the commercial gas-truck business, since the excess profits derived from the pleasure-car business have been used for the development of commercial gas trucks. The electric truck has been given as much encouragement as possible under the business conditions formerly prevailing.

Mr. Lloyd said that a detailed study has been made recently of the possibilities of greatly stimulating this development. In this investigation there have been taken into account the experiences met with and the conditions prevailing in different cities, together with the peculiar situation confronting the entire industry due to the war. It is believed that the Government will probably place large orders for gas trucks with the manufacturers of these equipments, which will make the securing of such trucks for ordinary commercial purposes very difficult. It is also possible that owners of commercial gas trucks may be requested to place them at the disposal of the Government for military purposes. A shortage of skilled gas-truck drivers after the draft army is mobilized is likely to develop. The cost of gasoline is steadily increasing. These conditions, together with the undisputed fact that Chicago is peculiarly suited for electric trucking, have brought about the development of a new and comprehensive plan, which the Commonwealth Edison Company offers in terms substantially as reported in a special article in another part of this issue.

Directly after Mr. Lloyd had made public the general features of the new service, W. P. Kennedy, who has devoted a great deal of study to the conditions prevailing in Chicago and who, as consulting engineer, had drawn up the chief features of the plan, spoke of the importance of this new service, which he said would doubtless prove an example for other cities. The electric truck is just as good a delivery proposition as it ever was. Recently it has been fighting very severe odds, however. The conditions prevailing on account of the war are making it an especially appropriate time to launch the new service. It is highly probable that the purchasing of gasoline commercial trucks will become very difficult in the near future. At the same time, the drafting of large numbers of men for the military service will reduce the supply of labor available. The rising costs of gasoline also will have an important part. Consequently, Mr. Kennedy thought that this was the psychological time to give the electric truck a powerful impetus.

In Chicago there are from 60,000 to 70,000 horses in use for general delivery service. An astonishingly large number of these are in use by the delivery departments of large companies or by large teaming concerns. Mr. Kennedy felt certain that the owners of horses and teams could save from 15 to 40 per cent by electrifying their delivery service; the larger saving could be effected by rearranging deliveries on a more intensive and efficient basis. Although the number of automobile trucks in use has undoubtedly increased very largely the use of horse-drawn trucks has decreased recently only from two to three per cent. All of these conditions show a very favorable situation for decided stimulation of electric truck delivery. In New York City, for instance, the use of motor trucks has practically doubled within a few years. The economy that trucking makes possible very quickly pays for the investment involved. A saving of 25 per cent in the delivery costs will soon repay the entire investment of the electric trucks.

Mr. Kennedy said that the Edison Company will, by means of its salesmen and general publicity work, undertake the educational campaign necessary to interest team owners. Exact studies of conditions prevailing will be made for these interests and estimates prepared of exactly what it will cost them to undertake electric delivery. The contracts to be made for the new garaging and maintenance service will be on a long-term basis, so that the costs of the new service will be definitely known, thus making it easily possible to convince those making the change exactly what saving will be effected. In conclusion, Mr. Kennedy said that the electric-truck busi-

ness was, in his opinion, the most promising field in the electrical industry now, and in fact, in the automobile industry. This new electric commercial-truck development will probably have an important result in stimulating greater development of electric cars.

Preceding the addresses by Messrs. Lloyd and Kennedy there was made the annual address of the chairman of the section, G. H. Foster, who reviewed the activities of the Chicago section and pointed out the decided impetus that had been given through its efforts to the standardization of battery jars, vehicle lamps and standards of service. There is needed further development of the garage policy and need also for a good garage cost system. The free parking service provided in Chicago has proved exceedingly successful for two years, no complaints whatever having been made and but few minor troubles experienced.

Election of officers for the Chicago section resulted as follows: Chairman, E. M. Simpson; vice-chairman, W. F. Bauer; secretary, L. C. Spake. A brief address was made by Chairman-Elect Simpson, after which H. Salvat spoke briefly of the good conditions existing in the Chicago field, which he attributed very largely to the active and cordial co-operation offered by the Commonwealth Edison Company. As a token of its appreciation of the valuable service rendered during the past two years by Retiring-chairman Foster, a jeweled watch fob was presented to him.

PROGRAM FOR ANNUAL CONVENTION OF NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION.

Meeting to be Held at Spokane, Wash., on September 12 to 15, Inclusive.

The annual convention of the Northwest Electric Light and Power Association, which is a geographic section of the National Electric Light Association, will be held at Spokane, Wash., on September 12 to 15. Careful consideration has been given to the advisability of calling this annual meeting under present conditions, and it has been felt that it was necessary to hold the meeting as planned in order to express confidence in the stability of our national government. Although the program at the present time is of a tentative character, it gives promise of being exceptionally interesting in its final form. As now planned, the program is as follows:

Wednesday Morning Session.—Address of welcome by the mayor and response by D. L. Huntington. Committee reports. Annual address of President M. C. Osborn. Paper on "Aphorisms," by J. C. Ralston.

Wednesday Afternoon Session.—Paper and general discussion on "Practical Central-Station Salesmanship," led by L. A. McArthur, of Portland, and participated in by George Bowen, S. A. Hoag, H. W. Lines, L. A. Lewis, C. R. Young, and others.

Thursday Morning Session.—Paper and general discussion on "How the Engineer Can Assist the Commercial Department," led by D. F. Henderson, Spokane, Wash., and continued by G. L. Duffey, J. C. Henkle, A. S. Hale and L. T. Merwin.

Thursday Afternoon Session.—Paper and general discussion on "Co-operation in Modern Home and Apartment-House Wiring Practice," led by A. C. McMicken, and followed by H. H. Schoolfield, L. R. Grant, F. O. Broili and Foster Russell.

Thursday Evening Session.—Illustrated lecture on "Commercial and Residential Illumination," by F. D. Fagan, manager of the General Electric Company's lamp sales on the Pacific Coast. For this lecture, which will be open to the public also, the largest theater in the city will be engaged.

Friday Sessions.—Both morning and afternoon sessions will be devoted to the report of the Electric Range Committee, to be presented by W. R. Putnam, Salt Lake City, Utah, chairman. In connection with this report there will be read a paper on "Busbar Diversity of Ranges," by H. B. Peirce, also one by Prof. B. L. Steele, giving results of tests on ranges and range loads.

The annual banquet will be held on Friday evening. Arrangements are also anticipated for including the usual yearly paper on "Experiences and Wrinkles." Entertainment features will be well taken care of throughout the meeting and on Saturday it is planned to have a visit to the large mine and new smelter at Kellogg, Idaho. J. F. Farquhar, Spokane, Wash., is secretary and treasurer of the association.

MEETING OF ELECTRICAL COUNCIL OF UNDERWRITERS' LABORATORIES.

First Business Session Discusses Standards for Molding and Fuses—Other Important Matters Considered.

The second meeting of the newly organized Electrical Council of Underwriters' Laboratories was held at the principal office and testing station at Chicago, Wednesday and Thursday, May 23 and 24, the following members being in attendance:

Dana Pierce, chairman, New York, N. Y.; W. J. Canada, Bureau of Standards, Washington, D. C.; H. H. Clark, Bureau of Mines, Pittsburgh, Pa.; H. S. Wynkoop, Department of Electricity, City of New York, N. Y.; V. H. Tousley, Department of Electricity, Chicago, Ill.; H. F. Strickland, Hydro-Electric Power Commission of Ontario, Toronto, Ont.; L. A. Barley, Rocky Mountain Fire Underwriters Association, Denver, Colo.; R. C. Bird, Fire Underwriters Electrical Bureau, New York, N. Y.; W. S. Boyd, secretary Western Association of Electrical Inspectors, Chicago, Ill.; G. E. Bruen, Suburban Fire Insurance Exchange, New York, N. Y.; B. W. Clark, Public Lighting Commission, Detroit, Mich.; W. Devereux, Philadelphia Fire Underwriters Association, Philadelphia, Pa.; J. C. Forsyth, New York Board of Fire Underwriters, New York, N. Y.; B. H. Glover, Underwriters' Laboratories, Chicago, Ill.; W. D. Matthews, Chicago Board of Underwriters, Chicago, Ill., represented by F. G. Waldenfels; A. H. Miner, Underwriters Bureau of New England, Boston, Mass.; C. W. Mitchell, Board of Fire Underwriters of the Pacific, San Francisco, Cal.; I. Osgood, Boston Board of Fire Underwriters, Boston, Mass.; A. M. Paddon, Underwriters Association of New York State, Syracuse, N. Y.; E. H. Sigison, Buffalo Association of Fire Underwriters, Buffalo, N. Y.; R. P. Strong, Louisiana Fire Prevention Bureau, New Orleans, La.; A. G. Wilbor, Factory Insurance Association, Hartford, Conn.; F. A. Cambridge, City of Winnipeg, Manitoba, Canada, and F. O. Evertz, Department of Electricity, City of Columbus, Ohio.

The meeting was of particular interest and importance in that it was the first business session of this Council, and a lively interest was manifested by the members in the discussions of the scope of its work and the methods of procedure to be followed and the results to be aimed at both in the elaboration of standards for the construction of tests of electrical appliances and in the regular work of examining and testing appliances under such standards.

In addition to the considerable volume of routine business, action on new subjects included the following:

An extension was made to the existing standards on metal moulding to include surface metal raceways of one-piece design for use on two-wire circuits not exceeding 1320 watts capacity, and under this extension the new surface wiring raceway, known by the trade name of "Wiremold," was listed as standard.

On the subject of fuses action was taken directing that the staff engineers undertake an investigation with the view to reporting to the Electrical Council for consideration at a

future date suggestions for a possible set of specifications, method of testing, supervision, and field follow-up of the details of design, construction and performance under test of so-called refillable fuses.

W. J. Canada of the Bureau of Standards and H. H. Clark of the Bureau of Mines made interesting statements concerning the present tendencies in the construction of electrical devices from the viewpoint of accident hazards, and a resolution was adopted calling to the attention of manufacturers the desirability of paying more attention to these features in the design and construction of appliances.

The newly developed standard on armored cables was formally adopted. Other subjects of discussion included construction and use of miniature motion-picture machines and their special films, electrical heaters and pressing irons, ground clamps, bell-ringing transformers, and disconnecting plugs or receptacles of large capacity for battery-charging circuits and similar uses.

Enjoyable features of the sessions were a dinner to visiting members at the University Club of Chicago on the evening of May 23, and informal luncheons served at the offices of Underwriters' Laboratories on Ohio Street on the two days of the Council's meetings.

The large and very representative attendance, together with the interest displayed in all of the discussions, furnish additional evidence of the important part which this Council is destined to play both in the electrical work of Underwriters' Laboratories and in the electrical industry as a whole.

PRESIDENT LIEB ON THE PROBLEMS BEFORE THE CENTRAL-STATION INDUSTRY.

Noteworthy Comments in a Recent Address Before the New York Companies' Section, National Electric Light Association.

In addressing the New York Companies Section, N. E. L. A., J. W. Lieb, Jr., president of the National Electric Light Association, made the following pertinent statements:

In assuming the presidency of the National Electric Light Association, I am not unmindful of the very serious responsibility which that involves. If that responsibility was a grave one in ordinary times, it is much more so in these extraordinary times through which we are passing. It is indeed a responsibility which would weigh heavily on any shoulders, to have the honor of representing this industry at this time.

The opportunity for service, which the electrical industry affords, is a most extraordinary one, and I feel very sure that throughout the country the industry will rise and discharge in full measure the responsibility which it owes to the Nation, and perform the service which it is fitted to render.

In the first place, the Association is not only a nation-wide one, but it includes our ally, Canada. Every section of the Union is represented in our membership. We have in our ranks the leaders who have in the past done such notable work in bringing us to the forefront of industrial activities in this country, not merely in the wonderful expansion which has been attained under them, but also in procuring for this industry the leadership in many things which go far beyond the mere attainment of bigness or the mere attainment of great financial success—in expanding to meet all requirements and covering a field which, ever broadening, this industry has been able to occupy. And through its efficient leadership in the past it has been able to lead the way in many new directions—in welfare work—in work which involves a closer co-operation of employees with the companies—in work which involves a spread of educational advantages to all employees, and in other directions almost too numerous to mention. It is, therefore, evident that a business which has made such a record has taken upon itself a responsibility at this moment which is grave indeed, but which the history of the past gives every hope will be discharged fully and creditably.

Our industry at the present moment occupies a very peculiar relation to the crisis through which the Nation is passing. The country is engaged in a very grave and serious undertaking. How grave that undertaking is, perhaps none of us fully appreciate. We have, however, after a period of careful forethought and consideration of the issues involved, embarked upon this undertaking, and we are going to see it through. We know not what sacrifice of men and treasure we may be called upon to bear, but the die has been cast, our pledge has been given, and the Nation will stand behind the President in seeing this thing through to the finish.

In England, where the sister industries of gas and electricity occupy a relation not unlike that occupied in this country, there was an immediate rush to the front, a rush to volunteer, and the best men in the industry felt and responded to the call. After the first six months had passed, it was found that the wheels of industry were beginning to slow down, that the production was not adequate to meet the constantly growing needs and demands from the front, and it was somewhat of a shock to find that many of those upon whom depended the successful conduct of enterprises of an industrial nature had gone to the front, and, alas, many of them beyond recall.

It was determined to bring many of them back—it was a matter of necessity—and they were brought back. They returned to assist in mining the coal, to assist in running the railroads, and to assist in running the utilities with which we are more immediately associated.

It is, therefore, for us to profit by the experience of our allies, profit by the mistakes they made, and the sacrifice in blood that that bitter experience cost. And, therefore, I feel it a duty laid upon me to ask you particularly to consider the words which the President has spoken in the several historic letters which he has written since the call to arms, and in which he lays upon us the responsibility of considering our obligation as an industrial army as well as a fighting machine front.

The Coal Situation.

Now there are very many problems which this industry will have to meet, serious problems, problems that are new not only to us, but which were new to those who went through this experience some years ago abroad. We are already receiving, or having a foretaste, of what some of these problems may be. The problem of coal supply is one of the critical ones with which we are already face to face, a problem which, in its many aspects of labor involved, transportation involved, the curious operations of the laws of supply and demand set at naught by peculiar circumstances, is a very difficult one today. Undoubtedly it will be necessary in the very near future to provide for some special handling of a problem of this importance, due to a removal of the limitations which the present laws invoke. At present the laws require that there shall be no discrimination, no preference, as between goods or commodities shipped to this or that consumer. Presently the pressure to obtain coal will be such that in order to keep the wheels of industry going, it will be necessary to discriminate in order that those who are in great need of the commodity and those who are engaged in work and in productive enterprises that are necessary to the conduct of the war, shall have the preference.

This is one of the great problems with which the Nation is faced and with which our industry is faced.

Labor Conditions.

Another problem is the demand and the necessity for adequate labor in the conduct of our enterprises. We are deprived of that tremendous influx of labor, which has taken place for years, from Europe, to operate our mines and build our railroads. That work must be carried on in larger meas-

ure than before by labor that is within our own borders, and this creates a scarcity which makes it difficult for the industries to obtain all the labor that they require. And what, with the demands that are being made by munition plants, plants engaged in the production of arms and supplies of all kinds, in the construction, now, of our fleets to carry supplies and food to our allies abroad, this problem is one of great difficulty.

Another problem, which is a most difficult one, is the question of what shall be done in the direction of taking care of the dependents of those who go to the front. It is probably too early to make any pronouncement as to what may be the ultimate solution of this problem. It is one that requires the most mature consideration on the part not only of the Nation, but also of the industries that are put hard to it by these conditions that we are facing now to a small extent, but which will continually become more grave. Therefore, the industries cannot go lightly into assuming obligations, making promises or holding out inducements which they may become unable to discharge. These matters are being considered at Washington—they are being considered by those who conduct large industrial enterprises, and I need hardly say, also by those who are conducting the enterprises with which we are more intimately associated. And that soluution, you may be assured, will be found, which will go as far as it is possible to go in the endeavor to meet the necessities of those who, from our midst, may be called upon to serve their country.

Conditions Abroad.

I would like to say a word or two at this time (it would be more interesting if more time were available) of what is being done abroad by the electric light companies. The first effect on many of the properties was to check their development. But, with the great elasticity of their organization the new demands which were made upon them by industries that were developed, by the more intensive operation of others, that first slacking of demand was largely compensated for and a more normal condition succeeded it.

In Germany a peculiar condition arose, due to the difficulty of obtaining fuel oil, with the result that a very much increased load was put upon the central electric lighting stations. In Austria a large number of stations were operated by Diesel engines. Because fuel oil could not be obtained and a large number of plants which used Diesel engines for motive power and which were necessary for the production of war supplies, could not obtain the necessary fuel for their operation, they had to be connected to the central stations. So that the central station, while finding it necessary to curtail production in certain directions, had to expand to satisfy the continually growing manufacturing demand.

But the most interesting problems which our enemies, Germany and Austria, were called upon to meet, were the scarcity of metals. Very early in the war it was necessary to mobilize the metals as well as the men. An interesting study developed in trying to meet the demands of industry with metals which were available as a substitute for those which could not be had. Most interesting substitutes and most interesting substitutions were made for copper, for which the demand in the earlier periods of the war was such that it could not be met by the ordinary resources of the country. No importation was possible. We find the construction of generators, of motors and transformers, made with zinc windings instead of copper windings; we find iron used in collector slip rings; we find zinc instead of copper as the material from which cables and wire were made. We find copper removed from many of the overhead systems and iron substituted. We find that new problems have arisen. Zinc, with a conductivity twice that of iron, was able to get through and was able to displace copper, or take the place of copper, with a carrying capacity of something like fifty percent of what an equal cross-section, at equal rise of temperature, resulted in the case of copper. Many plants have been taken down, many more economical systems have been substituted for old and antiquated systems, all reserve apparatus has been removed and taken to points where the demand was greatest. All this readjustment of the industry has brought forward many new problems, and some of the substitutes which were devised and found out will no doubt rest as permanent acquisitions to the industry even after the war is over.

We see now in England a strong agitation for the centralization of power supply, and dozens of committees are at work unifying the systems all over England, bringing adjoining systems into co-ordination and correlation; so that the industries are busy in solving these new demands which are being made upon them.

There is another direction in which we can all be of service, and that is in endeavoring to furnish the money which it is necessary to have in order to conduct the fight on the colossal scale that the demands of war bring upon us, and I wish at this time to appeal to you to render, each one of you, as your means may permit, your support to the great Liberty Loan.

That is a patriotic duty which each one of us, in some measure, can discharge, in which each one can make himself a part of this great work, and to lend of his means in order that the war shall be properly and efficiently conducted. And I have no doubt that in the very near future plans will be forthcoming, and will be laid before you, under which our companies may be allowed to act as the agents for bringing this loan close to you and making it practicable, so that your participation may be conducted conveniently and economically.

EDITORIAL CONFERENCE CONSIDERS WAR PROBLEMS.

Editors of Business Papers Told of Crisis Facing Nation and Democracy.

Members of the Cabinet and others actively engaged in the conduct of the war outlined war aims and needs at a meeting of editors of the country's technical and trade publications held in Washington, D. C., May 25. All emphasized the magnitude of the task, and urged the publishers to support the Government.

The food situation was presented by Herbert C. Hoover, who said the country faces a war that probably will last from two to five years. Only by the most careful measures can the United States give the Allies enough foodstuffs to bring victory, he said.

Secretary Lane set forth the purpose of the United States in entering the war.

"We are fighting feudalism," he said. "The German ruler is willing to go to any length to see a feudalistic system established. The fiend of war himself would not stand for what the Germans have done in the last two years. Our interest as a nation and as a democratic people is involved. The power that would do things that have been done would, if England were conquered, demand Canada and we would live in haunting fear the rest of our lives.

Fighting for Something Real.

"Put it in your editorials that America is fighting for something real, that we do not want to go back to where one man can enforce his will on a hundred million people, and where a man in khaki could be the master of the fortunes of this country."

Secretary Baker said the outcome of this war would show whether the world really is progressing.

Every resource of the Allies, Mr. Baker said, was near exhaustion when the United States entered the war. There is no way to establish permanent peace, he asserted, except through exercise of the superior power of the United States.

In mobilizing every resource, said he, profound industrial changes were sure to come and the help of the publications was needed to prepare people for the change.

Secretary Daniels asked the editors to "get it into the heart of business men that it is a crime to make more out of the war than a normal profit." The press, he said, is responsible for letting the people know everything about the Government, and the spirit of the Administration is "that comment and criticism are the very life of a democracy."

The purpose of the export limitations and trading with the enemy bills were explained by Secretary Redfield, who said the measures were necessary as a protection for the country's commerce and resources.

The Government's attitude toward labor was discussed by Secretary Wilson. No changes in wage standards, he said, should be attempted without first giving the Government a chance to mediate between employers and workers.

What the general munitions board is doing was told by Frank Scott, its chairman. In the battle of Gettysburg, he said, the Union army in three days fired only 32,000 shells, while today the same number of guns would fire that number of shells in three minutes.

Frank A. Vanderlip, president of the National City Bank, New York, told the editors and Cabinet members that the success of the United States in the war would be measured by its degree of organization.

SUPPLY JOBBERS HOLD IMPORTANT CONVENTION.

Spring Meeting at Hot Springs, Va., Votes to Buy $10,000 Worth of Liberty Bonds and Purchase Ambulance for Service in France.

The Spring meeting of the Electrical Supply Jobbers' Association, which was held at Hot Springs, Va., May 22, 23 and 24, was one of the most successful in the history of the Association, both in point of attendance and business transacted. An interesting happening was the decision to purchase, in the name of the Association, Liberty Loan bonds to the amount of $10,000. The secretary was also authorized to expend $2,000 for the purchase of an ambulance for service in France.

Three addresses were made during the meeting, one by Capt. Edwin W. Moore, president Habirshaw Electric Cable Company, on "The Wire Problem"; another by C. E. Corrigan, vice-president National Metal Molding Company of Pittsburgh, on "Rigid Conduit," and the third, on "Selling Electrical Service," by James M. Wakeman, Society for Electrical Development.

THE WIRE PROBLEM.

In his address Captain Moore outlined the merchandising functions of the jobbers and of the contractors and dealers and the relations that should exist between them and the manufacturers. He said in part:

"One of the essential factors in stabilizing business and preventing demoralization in price is establishing among manufacturers, contractors and jobbers an accurate system of cost accounting. The lack of such a system lies at the foundation of destructive competition.

"So far as we are concerned, we do not regard wire as sold until it is actually installed in service; in other words, we feel that after we have made our sale to the jobber it is up to us to help him with the sale of the wire to the contractor, and that after that we must help the contractor to sell it to the owner.

"Every one of our policies, therefore, is carefully scrutinized from the owner's point of view. We believe that there is nothing in the long run that will prove so economical to the consumer as distribution through the jobber and the contractor. You will note that we say 'economical'—not 'cheap.'

"We believe, as we have said, that we are not far from solving this proposition, and when we have solved it and have created a satisfactory market for our material with the contractor's customers we have no doubt in the world that he will see the wisdom of dealing with the jobber, and that he will establish fair and satisfactory relations with him. We believe that within a short time we will be able to see our business flow through regular channels.

"It is our intention to protect the jobber in every way possible. We realize that the jobber is severely handicapped in doing business by the necessity of carrying a stock, by the maintenance of a warehouse, and by the credit risk which he is absolutely obliged to take in the case of a large number of small customers; and for these reasons we think the jobber should be protected by granting him a lower price than any one else will receive who does not accept the same obligations.

"The same applies to the contractor. As he lightens his burdens by making the jobber carry a large stock and a large force of salesmen, while he himself is carrying only a small stock and considerably less sales expense, so he, too, in turn, will be protected against the consumer, who carries none of these burdens, and who, consequently, must pay a profit to the contractor and to the jobber.

"It is our idea that 'quality' and 'service' are the two things which the owner of the building is entitled to have. We will furnish the 'quality' and stand responsible for it, but it is up to the jobber and the contractor to furnish the 'service.'

"We are not the least afraid that we are not going to succeed in our policy, because we have already attained success, even though our policy is not as yet fully worked out in all of its details. We do believe, however, that we should receive co-operation, and thorough, co-operation, from the jobbers. We do not want the jobbers to go around and say that they handle two kinds of wire, one 'quality' and one 'cheap.'

"We do not think that any jobber should handle anything but good wire, and this does not mean either that we expect all of the electrical supply jobbers in the country to sell nothing but our material. We do feel, however, that no jobber should sell or buy any wire because it is cheap. He is neglecting his obligations to the public when he adopts this attitude.

"If he is now handling what is known as 'cheap' wire, he should immediately investigate the supplier's methods, both manufacturing and selling, and make absolutely certain that nothing is neglected in inspections, and satisfy himself that the material is up to the proper standard.

"We cannot emphasize too strongly to the jobber the importance of driving every manufacturer to adopting a standard policy of recognizing the jobbers. This is the only sane policy in the electrical business, and if a manufacturer is not intelligent enough to adopt such a policy, then his selling methods are open to question; his manufacturing methods are also under fire.

"The jobber must accurately examine his cost of operation and sell no wire except at a profit. He must insist on buying and selling a 'quality' article only. He must deal on prices based on the market, wherever possible, and he must adopt a policy and stick to it. Don't let a salesman who has been unable to sell a standard article come along and show his ability by talking you into using a cheap article which is sub-standard. Convince yourselves that what you are doing is absolutely right, and convince your salesmen, and they will get you the orders, but make your policy and stick to it through thick and thin. A policy is not much good if it does not sometimes take a little courage to carry it out."

Mr. Corrigan, in his address, ably outlined conditions in the rigid-iron-conduit market. The supply is now quite limited, he said.

NEWS NOTES

Annual Outing of New York Jovian League on June 19.—The annual outing of the Jovian League of New York City will be held at the Harlem Yacht Club, Island City, on Tuesday evening, June 19. An elaborate entertainment program is being arranged.

St. Joseph Company Wins Packing Plants.—The latest packing plant in St. Joseph, Mo., to recognize the economy and efficiency of central-station power is the Morris Company, which recently closed a contract with the St. Joseph Railway, Light, Heat & Power Company for 1150 horsepower.

Commission Allows Rates to Stand.—The Bronx Gas & Electric Company, New York City, will be permitted to continue its present charge of 12 cents per kilowatt-hour for electricity, according to a ruling made by the Public Service Commission when it approved the report made by Commissioner Travis Whitney permitting the rates to remain.

Michigan Section, N. E. L. A., to Hold No Convention This Year.—The Michigan Section of the National Electric Light Association has decided not to hold a convention this year. It has been the custom for many years to hold the convention aboard boat on a cruise of several days on the Great Lakes. War conditions make the gathering inadvisable because of the time and expense usually involved in these meetings, which in normal times has been well repaid.

New Jersey Electrical Contractors Meet.—The Electrical Contractors' Association of North Hudson held a meeting on May 18, followed by a supper at Miller's Hall, Union Hill, N. J. About 63 members were present and an interesting social entertainment was provided. A. M. Everson of the Board of Underwriters was presented with a diamond fob and charm, as a token of appreciation for his work in connection with the organization, prior to his association with the Board. A. Hildner is president of the association.

Bridge Tolls for Utility Companies.—Governor Brumbaugh, of Pennsylvania, has signed the Senate bill providing for the construction of bridges by counties and the imposing of tolls and rentals for use by street railway, electric, telegraph, telephone and other utilities. In approving the measure, the Governor says: "I have in mind that the inclusion of telegraph companies in the bill was, perhaps unwise and its provisions may not stand the test of judicial decree. However, the other provisions are so entirely wise, it does not seem right to veto the bill."

Consolidation of Ohio Utility Companies.—A dozen minor electric light and power companies in the vicinity of Youngstown, O., operated by the Mahoning & Shenango Railway & Light Company, have been consolidated under the name of the Shenango Valley Light Company, following action of the directors to that effect. The consolidation of the companies is a progressive step in the development and extension of the parent company's light and power service in that section, but indicates no change in management of operation otherwise.

Wire-Tapping Bill Vetoed in New York.—Governor Whitman has vetoed the bill passed by the Legislature to prevent eavesdropping on telephone lines, excepting on order of the Supreme Court. A similar measure, also passed by the Legislature exempting telephone and telegraph employees from furnishing prosecuting officers with information regarding messages, has met like disapproval from the Governor. In this, he says: "I fear that the enactment of this legislation, from information in my possession, might be embarrassing to the Federal authorities under present conditions."

Summer Meeting of Illinois Electrical Contractors.—The midsummer meeting of the Electrical Contractors' Association of the State of Illinois will be held at Peoria, Ill., on Friday and Saturday, June 22 and 23. This is the semi-annual gathering of the association and its annual business meeting. It is expected that Robley S. Stearnes, president of the National Electrical Contractors' Association, will be in attendance, together with several other instructive speakers. L. B. Van Nuys, Peoria, Ill., is secretary of the Illinois association.

South Dakota Central-Station Convention.—The second annual convention of the South Dakota State Electrical Association was held at Sioux Falls, S. D., on May 17 and 18. There was an attendance of over 50 members. Many important discussions took place, one of which included a lecture by Prof. W. T. Ryan of the University of Minnesota. At the election of officers for the coming year there were chosen the following: President, N. C. Draper, Sioux Falls; first vice-president, John F. Cameron, Armour; second vice-president, E. J. Sherwood, Mitchell; secretary and treasurer, Frederick D. Brown, Sioux Falls.

A Banquet to A. B. Paterson of Meridian.—A farewell banquet was given in Meridian, Miss., on May 9 in honor of A. B. Paterson, former manager of the Meridian Light & Railway Company, who is leaving to enter the bond department of the Doherty organization at New Orleans. One of the speakers said of the guest of honor: "He came here as a young man with nothing but his splendid character to back him, and he established a character that has won for him the esteem and confidence of the people, that took him from a subordinate's place to manager of the company." H. E. Brandli takes place left vacant by Mr. Paterson's departure for New Orleans.

Heavy Demand for Exhibit Space at Stationary Engineers' Convention.—Announcement is made by Secretary T. C. FitzGibbon that the time is drawing to a close when space can be reserved for exhibit space at the eighteenth annual state convention of the National Association of Stationary Engineers of Pennsylvania, to be held in Sharon, Pa., on June 21, 22 and 23, 1917. A partial list of those who have arranged for an exhibit follows: Anchor Packing Company, Andrews Bardshaw Company, The Edwardes Valve Company, The Bowers Rubber Company, Johnson, Morehouse & Dickey; Quaker City Rubber Company, Lubricating Metals Company, Fruit-Ohl Company, Hawke Boiler Compound Company, Henry Knock, Cawley Supply Company, J. F. Lanning Company, Everlasting Valve Company, Lunkenheimer Company, Jenkins Brothers, H. W. Johns Manville Company, France Metallic Packing Company, Dearborn Chemical Company, Garlock Packing Company, The Philadelphia Bourse.

Electric Waves.—At a largely attended joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, held in Chicago on May 28, William S. Franklin, professor of electrical engineering at Lehigh University, gave an illustrated lecture on "Electric Waves." He showed by very simple mathematical equations the fundamental relations of the transmission of electric waves and their similarity to waves in a string or other medium. Experiments showed very clearly the reflection and other phenomena of wave motion and how similar phenomena occur in the firing of ordnance and even ordinary rifles. Following the lecture, W. C. Bauer, professor of electrical engineering at Northwestern University, explained how these principles were used by him in wrecking a dormitory building that had been destroyed by fire. At the opening of the meeting there was shown a motion-picture film showing household and industrial uses of electricity interwoven into a little drama. Election of officers of the Chicago Section, A. I. E. E., was announced as follows: Chairman, W. J. Crumpton; secretary, C. A. Keller; member of executive committee, T. Milton.

Commonwealth Edison Company To Establish Electric Truck Service

Important Announcement by Chicago Central-Station Company of Comprehensive Garage, Charging and Maintenance Service To Be Offered for Commercial Electric Vehicles—Expected to Stimulate Electric Truck Business Greatly Because of Definite Costs and Favorable Conditions

By E. W. LLOYD

General Contract Agent, Commonwealth Edison Company.

THE Commonwealth Edison Company, after investigating carefully the cost of operating electric trucks in Chicago, has decided to offer to the public a complete garage and maintenance service for commercial electric vehicles at specific rates per annum on long-term contracts. This service will be so comprehensive as to cover all the doubtful elements of transportation expense, and will thus enable any customer to determine in advance just what it will cost him per year to operate any size fleet of electric trucks.

Furthermore, since it is a well known fact that wherever electric trucks are intelligently applied in superseding horse-truck service there is considerable reduction of operating expense below the horse-truck cost, the contract made between the Commonwealth Edison Company and the truck users will therefore serve as an insurance of this cost reduction, because it covers all the unknown quantities, and the remaining factors in the expense are only those concerned with fixed charges, insurance, and drivers' wages, all of which are known quantities and hence the total cost can be definitely settled in advance for a period of years.

Outline of Service.

The proposed service will naturally first cover the ordinary garaging or storage, including the cleaning and care of vehicles. Secondly, it will include the supply of energy for charging the battery and in the third place it will provide for the maintenance or upkeep of the wearing parts of the vehicle, including tires, battery and mechanical parts.

This maintenance will cover minor repairs of all kinds as well as the renewal of tires and battery when worn out. It will also include painting of the body at specified intervals, and provide for retouching and varnishing at intermediate times.

Such service will obviously relieve the customer of administrative expense and the cost of supervision, both direct and indirect, which he would have to bear if he operated the vehicles in his own garage. It must be understood that the owner pays the drivers' wages, insurance, and the cost of damage by accidents.

General Conditions.

New trucks only will be accepted for the service. The rate for each size, equipped with standard battery, will be a flat figure per annum payable monthly in 12 equal parts. Trucks equipped with batteries of sizes larger than the standard will be charged for at proportionally higher rates. The working radius of the truck which the flat rate is intended to cover is that amount of service which can be procured from one charge of the battery daily. If the work to be done by the user should be greater than this and such as to require additional charging during the day, or the use of extra batteries, the flat rate above mentioned will be increased accordingly. Thus the whole system, while based on a flat rate for minimum service, is really a measured-service scheme depending upon the requirements of the user. As the service proposed will provide for renewal of battery, tires, and mechanical parts when they wear out, the customer's vehicle will be practically as good as new at the end of the contract period, except for such depreciation as may have taken place in the nonwearing parts.

The Immediate Undertaking and Plans for the Future.

The Commonwealth Edison Company is having a large service station erected at the corner of Jackson Boulevard and Morgan Street, a location which is very close to the trucking center just west of the main business or "loop" district. This building, which should be ready for use by the end of the summer, will render service to one hundred electric trucks. Should this space be taken up quickly, additional space will be provided in the same neighborhood for a further trial of the proposed service.

The company is also planning to establish other service stations as the project develops, beginning with one on the north side and one on the south side of the loop district, if the first undertaking demonstrates a satisfactory demand for this type of service.

The Commonwealth Edison Company will employ a specially qualified staff for the development and conduct of this service. Salesmen, supplemented by transportation engineering service, will be able to present to prospective customers having large horse-truck equipments facts and figures which will completely satisfy them as to their present expense, and will subsequently present statements which will prove the reduced expense to be effected by substituting electric trucks for these horse equipments.

Already considerable research work has been done to determine the size, location and other characteristics concerning the principal horse-truck equipments now in Chicago, and by conducting an intensive campaign in showing the truck owners local to this service station the annual value to them of the service to be rendered, the company will automatically develop such horse owners to the point where they will be ready to purchase electric trucks from the manufacturers of these vehicles.

This undertaking is the broadest of its kind, and is intended to eliminate the difficulties experienced in other partial service systems, since the plan covers by one contract for a term of years the complete maintenance costs of the equipment used, a proposition which electric truck owners have never had offered to them before this undertaking.

A meeting of the Electrical Manufacturers' Club was held at Delmonico's, New York, on May 17. It replaced the May meeting usually held at Hot Springs, Va. Resolutions were passed offering the co-operation of the club with the Council of National Defense. Aside from this action only business of a routine character was transacted.

Power Transmission from Windsor

All Power from New Windsor Plant To Be Transmitted at 130,000 or 66,000 Volts—Description of Line Crossing Over Ohio River and of the Windsor-Canton Line

By F. H. BERNHARD

POWER transmission at very high potentials has been effected in so many systems in this country as to no longer arouse the keen attention which was manifested in the early installations, especially on power systems employing over 100,000 volts. Heretofore, however, the very high tension power lines have been built almost exclusively in connection with hydroelectric developments to carry the power from remote water-power sites to centers of utilization. In last week's issue there were briefly described the general features of the large new steam-driven electric plant at Windsor, W. Va., one of the novelties of which is that practically all of the power to be generated will be transmitted at 66,000 or 130,000 volts. A description of the principal high-tension lines running from this plant may therefore prove of interest, especially since the longest line, the one running to Canton, is to be operated at 130,000 volts, which formerly was considered to be a rather high value for a transmission distance of about 55 miles.

Every detail of the Windsor power project has been planned so as to obtain the maximum possible efficiency in operation. It is not surprising, therefore, that transmission at almost the highest practical voltage was decided on for the Windsor-Canton line, which is to be not only the longest but, for some time at least, the most heavily loaded power line radiating from the new plant.

Aside from the Canton line, there have been built two 66-kilovolt lines crossing over to Ohio and connecting at a point over a mile from the Windsor plant with an existing steel tower line that has been in service for some time between Wheeling, W. Va., and Steubenville, O. This line has been supplying power at 66 kilovolts from the Wheeling Electric Company's steam plant to several towns in Ohio up to Steubenville and vicinity. It is a double-circuit line, one circuit of which has been temporarily connected with one of the two circuits of the Canton line, and is, through this means, supplying power to Canton in amounts ranging up to 7,000 kilowatts to relieve the heavy load on the Canton steam plant. This arrangement, of course, will be terminated when Windsor plant begins to feed the Canton line at 130 kilovolts. At that time it is planned to connect one of the two 66-kilovolt lines from Windsor referred to above with the line running south to Wheeling, and the other 66-kilovolt line from Windsor with the line running north to Steubenville. Each of these lines is a double-circuit line with one circuit on each side of the steel towers.

All of the lines mentioned in the foregoing are already completed. Work has been begun on several lines on the West Virginia side to be supplied from the Windsor plant. One of these will run over the hills back of Wheeling and connect direct with the Wheeling Electric Company's plant and system. Another will connect with the West Penn system.

Line Crossings Over the Ohio River.

The transmission lines leaving Windsor that are already completed cross the Ohio River on two special steel structures, a general view of which was shown in the illustration on page 877 of last week's article on the general features of the Windsor plant. A nearer view of these structures on the West Virginia side is shown in Fig. 1 herewith, this view being taken from the top of the 130-kilovolt switchyard structure. On the Ohio bank the steel structures are practically duplicates of these.

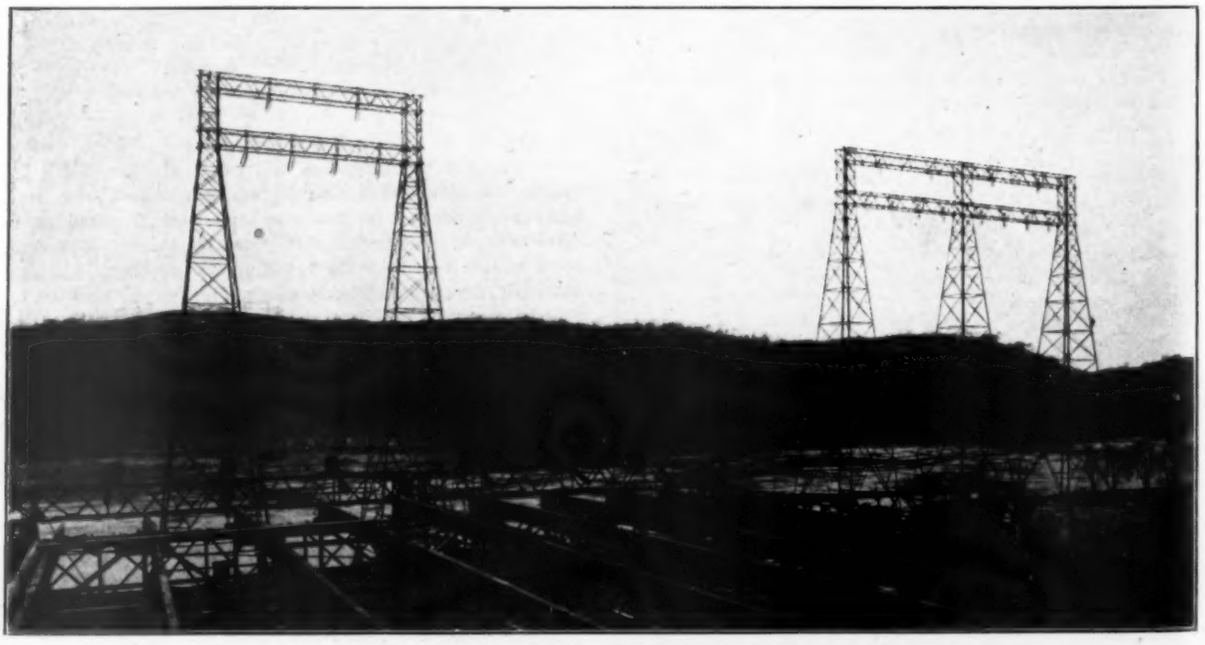


Fig. 1.—Close View of Towers No. 1 of Ohio River Crossing from Top of High-Tension Switchyard of Windsor Plant.

In Fig. 2 is shown the line anchorage at the western edge of the 66-kilovolt Windsor switchyard. This is where the transmission line proper begins. Each conductor of each of the four circuits is supported by a four-string strain insulator with short arcing horns. This illustration also shows the considerable elevation of the main floor of the switchyard above prevailing ground level. Concrete columns are used which will be entirely covered when the ground is filled to nearly the floor level, waterproof, concrete-lined tunnels being left between the columns for the 11,000-volt feeders from the generator buses, also other tunnels for the oil and water circulation of the large step-up transformers. This elevation of the switchyard is in order to get it above the highest flood level of the Ohio River. The anchorage for the double-circuit 130-kilovolt line is quite similar to that shown in Fig. 2.

The river span is 1500 feet, and the trussed tower structures on either end of it extend 165 feet 6 inches above the tops of the reinforced-concrete foundations, whose tops are above the highest recorded level of the river. These foundations extend down a total of 56 feet. Each structure consists of a double truss, from which the conductors for two circuits

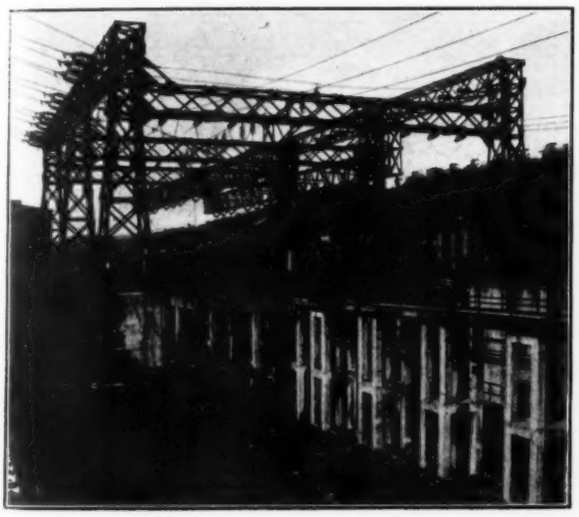


Fig. 2.—Anchorage for 66,000-Volt Lines at Windsor Switchyard.

are suspended by multiple-string insulators, the truss being supported by steel towers on 69-foot centers. These towers are 35 feet square at the base. The 130-kilovolt line has only one panel, but provision is made for adding a second panel to the north of that now built whenever it is decided to add a second 130-kilovolt double-circuit line. The 66-kilovolt line has two panels with provision for an adjoining third panel when the third double-circuit 66-kilovolt line is added.

These structures were designed for the following special loadings: Wind on conductors 8 pounds per square foot on one-inch radial ice coating, wind on towers, 13 pounds per square foot of 1.5 times the projected area. Additional loadings were provided for as follows: The bottom truss was designed for any two conductors broken; the top truss for any one conductor or ground cable broken; tower designed for any two cables broken. The unbalanced conductor or ground-cable pulls were figured at 12,000 pounds each. The towers and trusses were designed for vertical loads of 8000 pounds each at insulator or ground-cable supports.

Both the line conductors and ground cables for the river span are of phosphor bronze and are No. 0000 size 19-strand cables. The clearance of the lowest cables above low water is 110 feet, and the minimum clearance above highest recorded flood stage is 61 feet 3 inches. In stringing the cables for the span, as well as for all spans throughout the Windsor-Canton

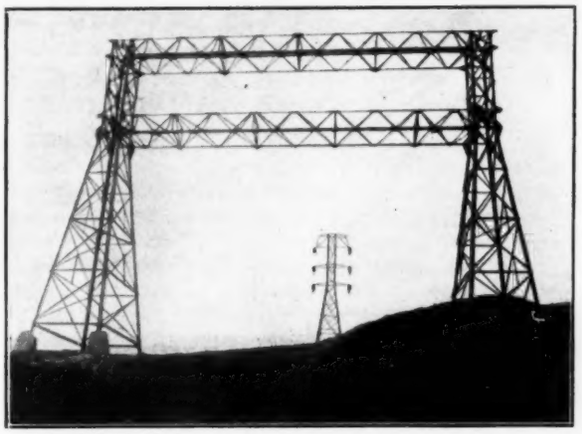


Fig. 3.—Anchorage for 130,000-Volt Line on Ohio Side.

line, dynamometers were used to pull the cables to predetermined tensions indicated on special sag and tension drawings.

In Fig. 5 is given the profile and plan of the river crossing and adjoining spans. The elevations shown are above mean sea level at Sandy Hook. The profile shows the abrupt rise of the line on the Ohio side, the Ohio anchorage structures (designated as towers No. 3) being located on the side of a fairly steep hill. Close views of these anchorages are shown in Figs. 3 and 4. These towers are 61 feet high above their concrete foundations. From these structures onward the lines are carried on individual double-circuit steel towers of standard types as used on the Canton line to be described below.

The river crossings and the portions of the lines extending to the junction with the Steubenville line are known as the Windsor-Junction transmission lines and are about 1.4 miles long. The rise in this portion of the lines is about 400 feet. A width of 600 feet is maintained by the right of way in this section, thus giving plenty of room for the erection of additional 66 and 130-kilovolt lines. The 66-kilovolt Windsor-Junction lines join the Steubenville line at a special structure between towers 28 and 29 of the latter, where this line will be cut and then connected to the junction lines, as already described. The Canton line crosses the Steubenville line close to tower 28 with abundant clearance between the lines. A temporary connection, already referred to, has now been made here to enable Wheeling power to be transmitted to Canton.

Windsor-Canton Line.

From Windsor to Canton the line is almost exactly 55 miles long. The upper portion of Fig. 6 shows that this line runs in a fairly direct line. As soon as the first turbo-generator unit of the Windsor plant is placed in operation,

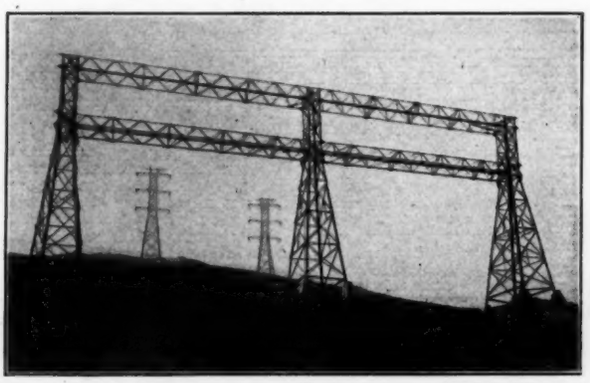


Fig. 4.—Anchorage for 56,000-Volt Lines on Ohio Side.

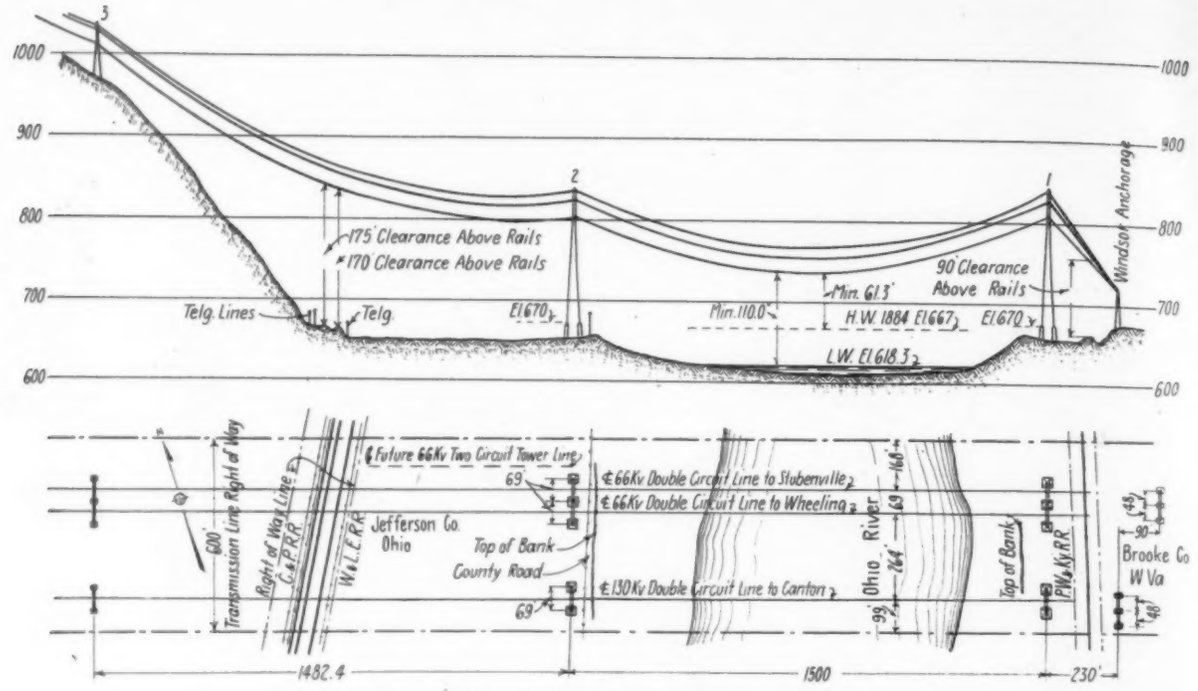


Fig. 5.—Profile and General Plan of River Crossing.

this line will be supplied at 130 kilovolts and operated entirely independent of all other lines. At the receiving end the voltage will be about 120 kilovolts.

General views of the tower construction are given in Figs. 7, 8 and 9. The first two of these also show the character of the country, which for the first 30 miles or so is quite rough, with many steep hills and valleys. The remaining portion is more rolling, making tower erection relatively easy. The right of way is nowhere less than 150 feet wide and much of it 200 feet, leaving room for the erection of additional tower lines paralleling the present one, which throughout is a double-circuit line.

The steel towers used are of three types, designated as A, B and C. They were supplied by the American Bridge Company. The type A towers are shown in Fig. 7; they are used on the straight and level portions of the line. These towers were designed for the following loads: (1) A horizontal pull in the direction of the line at any one conductor support of 5800 pounds, plus a vertical load of 1500 pounds; (2) a horizontal pull in the direction of the line of 4000 pounds at each of any two conductor supports on the same side of the tower acting in the same direction, or a total of 8000 pounds due to broken conductors; (3) a horizontal pull transverse with the line of 600 pounds at each of the six unbroken cables, and 300 pounds at each of the two broken cables, or a total of 4200 pounds due to wind on the ice-covered wires; (4) a wind load on the tower transverse with the line of 15 pounds per square foot acting on one and one-half times the exposed area of one side, or equivalent to 35 pounds per foot of height of tower; (5) a vertical load of 1000 pounds at each of the eight wire supports, or a total of 8000 pounds; (6) the weight of the tower. An overload of 100 percent was allowed for in the design and all loads listed above, except (1) were assumed as acting together.

Principal dimensions of the A towers are as follows: Over-all height 78 feet, to bottom cross-arm 50 feet; size at

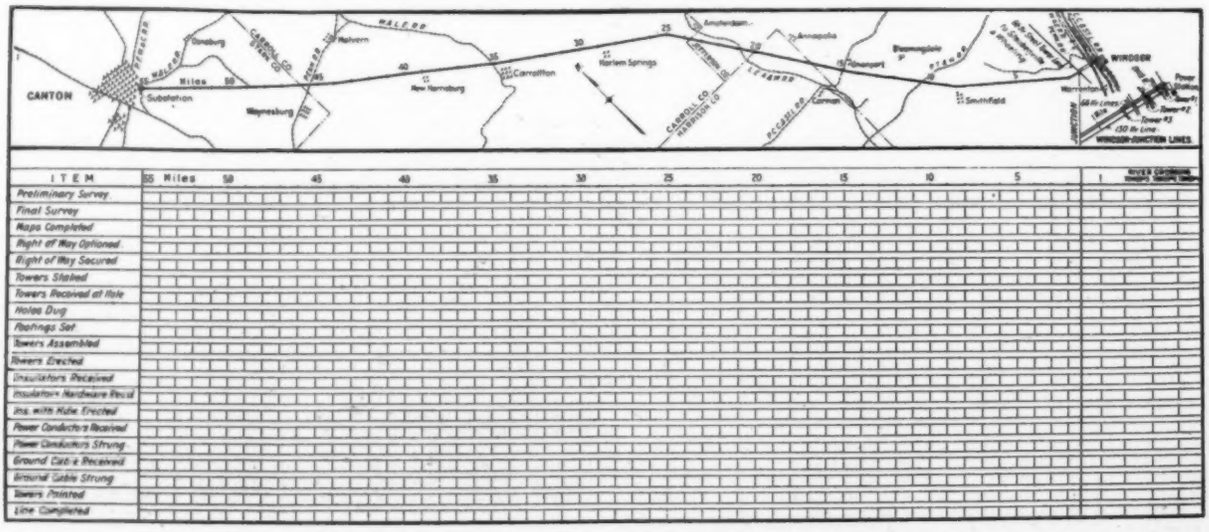


Fig. 6.—Upper Portion of Blank Weekly Progress Chart on Windsor-Canton Line, Showing Map of Line at the Top.

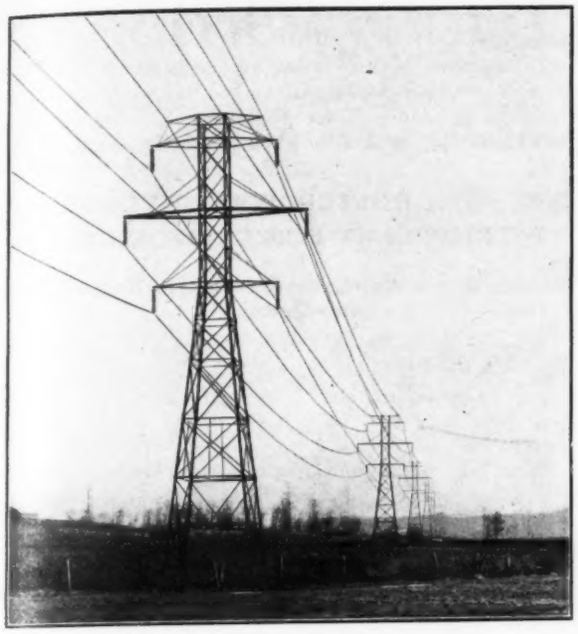


Fig. 7.—Typical Run of Type A Towers.

footing 15 feet 6 inches square, at top 4 feet 9 inches square; length of top and bottom cross-arms 21 feet 9 inches, of middle arm 31 feet 9 inches; vertical spacing, center to center, of arms 12 feet; footings 4 feet by 3 feet and 7 feet 6 inches deep, set in concrete block. The footings and cross-arms are galvanized.

Type B towers are used for longer spans or where the line is carried higher above ground. They usually have tower extensions of 10 or 20 feet. They are designed for additional loads above those for type A as follows: A horizontal pull of 1000 pounds at each of the six unbroken conductors and 500 pounds at each of any two broken conductors. Their footings are larger and deeper, otherwise they correspond closely with the A type. The nature of the tower extensions is well shown in Fig. 8.

The type C towers are used at strain and anchor points, being used on angles up to 45 degrees and at dead ends, except the river-crossing anchorages. They are designed for much heavier loadings than types A or B. Their height is 80 feet over all, with 10 or 20-foot extensions where needed. The footings are 6 feet by 6 feet and set 9 feet 6 inches deep.

Spans vary from 250 feet upward to the 1500-foot river crossing, the average being 583 feet. A total of 506 tower structures are used in the line, making an aggregate of 6,339,494 pounds of structural steel. Weights of the typical towers are as follows: A 10,300 pounds, B 12,000, C 17,000 to 22,000 pounds.

The copper conductors on the Canton line (outside the river crossing) are of 200,000-circular-mil cross section, a total of 1,812,762 feet of wire being used. The ground wires are ⅜-inch, seven-strand Siemens-Martin steel cables, with a total length of 604,254 feet. The minimum clearance of the lowest conductors above ground is 28 feet.

All insulators are of the suspension-disk type, made to definite specifications by the Ohio Brass Company. For straight suspensions 10 disks are used in a string, bringing the line conductor 5 feet 6 inches below the cross-arm. For longer spans, for strain points and at railroad crossings, important road or telephone-line crossings, 12 disks are used in a string. For heavier strain points, anchorages, and at the specially important crossings the insulators are assembled in two, three or four strings with special steel yokes. All of the insulator assemblies in the river crossing and anchorages are entirely special with triple or quadruple strings. Double-string and semi-tension assemblies are used quite freely on the B and C towers. The total number of insulator disk units employed is 45,540.

Delivery and Erection of Material.

Through careful planning, the delivery and erection of the towers and stringing of the wires was greatly facilitated and practically all lost motion eliminated. In loading the cars care was taken to assort the steelwork for the towers so as to permit systematic unloading and delivery. Similar members of the towers were loaded together on the cars, and material for a total of about three miles of tower line was loaded on four or five railroad cars. When the cars were brought to the unloading points, which were arranged, as far as possible, so as to necessitate not more than about three miles of wagon haulage, the teams were brought up alongside the cars and these quickly unloaded direct into the wagons, each team hauling sections of similar sizes. The wagons were loaded in accordance with the roughness of the country they passed over, so that each tower took from 3 to 7 wagons to complete its delivery on account of the varying topography.

The wagons discharged their material at definite positions from the base of the tower. The footing material was placed about 15 feet from the base. In the second pile was placed the material for the bottom section of the tower, in the next pile the members for the middle section, and, continuing in this way, the material was placed so as to avoid unnecessary handling in the assembling. The assembling crew, therefore, merely had to block up and bolt together the sections.

The towers were erected after complete assembling of their structural portions by means of an A-frame gin pole, the concrete foundations, of course, having first been completed. Delivery of the insulators, wire reels and accessory hardware was carried out in a similarly systematic manner, a

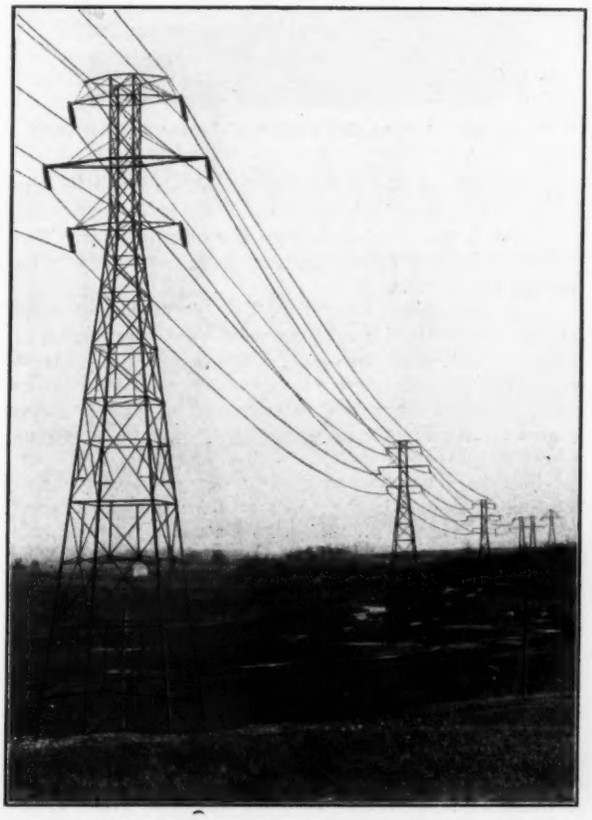


Fig. 8.—Typical Run of Type B Towers with 20-Foot Extensions and Double-String Insulators.

Jeffrey four-wheel drive gasoline truck with two trailers being used for the longer and heavier hauls; five teams were also employed. All of the wire was delivered in one-mile reels, the copper conductors totaling 324 miles and the steel ground wires 108 miles in the actual line from the river crossing to Canton.

In stringing the cables the reels were set up at intervals of 5250 feet, which allowed 30 feet for sag. Cable stringing was started at the Windsor end and the reel set-ups were made, as far as possible, on the high points of the line so as to facilitate handling the cable, and also to make the signals

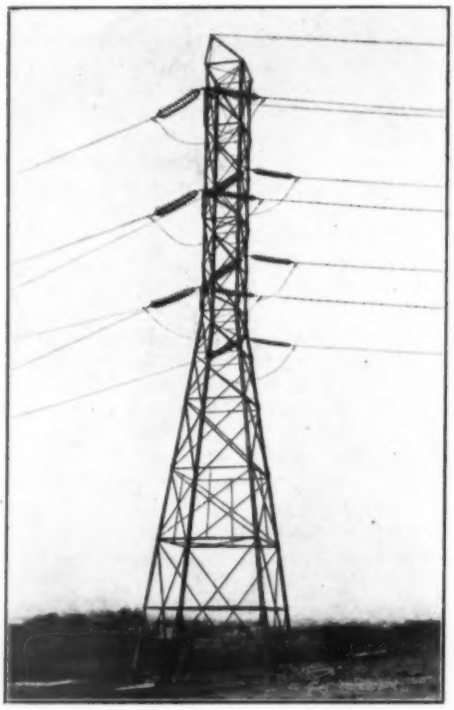


Fig. 9.—Type C Dead-End Tower at Canton Substation.

more easily discernible. As each reel was emptied it was loaded on a wagon and taken to the delivery point next ahead, from which it was shipped back to the manufacturer. This saved need for a separate clean-up gang coming back for collecting empty reels.

A very convenient, accurate and simple method of keeping progress records was used throughout the construction of the line. A portion of one of the progress charts is shown in Fig. 6. These charts were made out for each week. The progress obtained during the week covered by the report was indicated by filling in the squares in blue, while the preceding progress was shown in red. In the lower portion of the complete chart there appears a profile of the river crossing, somewhat similar to that in the upper portion of Fig. 5, except that the foundations are indicated by means of a double column of rectangles showing intervals of 10 feet. The rectangles on the left side were similarly filled in with blue or red to show the progress of the excavation, while the rectangles on the right were filled in to show progress in the concrete work of the foundations. This applied to the special towers Nos. 1, 2 and 3, which comprise the river crossing proper and the anchorage on the Ohio side.

Construction of the transmission line and river crossing was in general charge of F. W. Abbot, vice-president and general manager of the American Gas & Electric Company. The construction work was in direct charge of Frank Howard, general superintendent of the Wheeling Electric Company. Delivery and checking of materials was in charge of M. P. Kerr, superintendent of materials, Wheeling Electric Company.

In the issue of June 9 will be published an illustrated description of the substation at Canton, the receiving end of this line, together with some particulars regarding the principal distribution circuits radiating from this substation.

NEW 40,000-HORSEPOWER HYDROELECTRIC PLANT FOR CALIFORNIA.

Western States Will Spend $1,000,000 in Hydroelectric Development.

Western States Gas & Electric Company has filed application with the California State Water Commission for permission to conserve waters and create storage at Medley Lake, Echo Lake and Twin Lakes in the amount of 5000 acre-feet, 7000 acre-feet and 8000 acre-feet, respectively. It is estimated that this additional storage is necessary to operate the new hydroelectric plant which the company contemplates building above its present plant on the South Fork of the American River, about nine miles above Placerville. The present plant has a capacity of 8000 horsepower, and it is estimated that the new plant will be capable of developing 40,000 horsepower. Ultimately the company plans to spend approximately $1,000,000 on this enterprise.

ANNUAL MEETING OF NATIONAL ELECTRICAL CREDIT ASSOCIATION.

Prospects for Fine Meeting at Boston on June 28 and 29.

The eighteenth annual meeting of the National Electrical Credit Association will be held at the Boston City Club, Boston, Mass., on June 28 and 29. Arrangements are being made for a very successful meeting from every standpoint, in which entertainments will be taken care of on a generous scale. The meeting will open on Thursday with routine business and reports by the representatives from New England, New York, Philadelphia, Chicago and the Pacific Coast associations. Reports of the general secretary and treasurer, and other officers and committees will also be presented. A paper is expected to be presented covering the scope of the Electrical Credit Association. At the afternoon meeting addresses or papers are expected on the use and abuse of credit, cash discounts, and interest on overdue accounts. At the Friday morning meeting papers will be presented dealing with the moral risk, contractors' accounting methods, municipal "mumps."

A special committee has been appointed to take care of hotel accommodations and other details, which can be addressed in the care of the New England Electrical Credit Association, 15 State Street, Boston, Mass.

Cleveland Section, A. I. E. E., Holds Big Annual Meeting.

At the annual meeting of the Cleveland Section, American Institute of Electrical Engineers, held on the evening of May 21, the following officers were elected: C. M. Rakestraw, chairman; C. S. Ripley, secretary; G. N. Lindstrom, chairman of papers committee; L. P. Crecelius, I. H. Van Horn and R. B. Chillas, Jr., Board of Managers. During the past year 35 associate members and 10 local members have been added to the Cleveland Section. The business session was preceded by a banquet, and after the election of officers John B. Taylor, one of the managers of the American Institute, gave an illustrated talk on "Acoustical Engineering." He used a great variety of musical instruments in demonstrating the interesting points in his lecture and puzzled those in attendance by playing phonographic records backward.

Electricity in Construction Work

Second Article Dealing with the Characteristics and Horespower Requirements of the Machines Used in Outdoor Construction Work

By H. O. STEWART

Industrial Engineer, Rochester (N. Y.) Railway & Light Company.

IN the issue of May 26, the off-peak possibilities of outdoor construction work from the central-station standpoint were discussed and the advantages of motor-driven machines for this class of work pointed out. Among the more important advantages of the electrically operated machines may be mentioned the following:

Steam-operated machinery requires skilled labor. Such machines as pumps, stone crushers, and concrete mixers need no labor for their operation when motor driven. The lack of engineers or firemen will tie up a job using steam. It should be remembered that in freezing weather it is either necessary to draw the fires and remove all water from steam equipment each night or else keep a fireman on duty. The latter course is safer and is usually followed. Starting and stopping electrically operated machines is so simple that their operation is not dependent on the presence of any one or group of individuals. In other words, an electric motor requires no skilled or constant attendant.

Smoke, soot, noise and sparks from steam machinery have caused so much complaint in cities that it is not unusual to find in the specifications for certain work a statement that the contractor is to drive his machinery electrically.

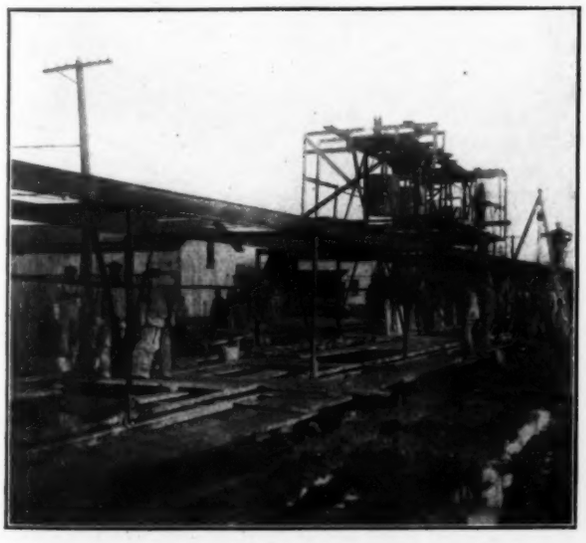
In order to be portable, the steam machine must be mounted on a truck and self-contained, that is, the engine, boiler, water tank, and coal bin should all be on a common base. Compare a portable motor-driven hoist, pump, saw, mixer or rock drill with a steam one. The electric output is more compact, lighter and easily supplied with power. The low-voltage wires can be supported on portable tripods or laid on the ground. The wires are placed in flexible conduit if liable to injury. For short runs which will be used only a limited time, double-braided rubber-covered wire can be laid on the ground, provided it will not be subject to abrasion or injury. The steam equipment has to be followed with a water pipe and coal wagon.

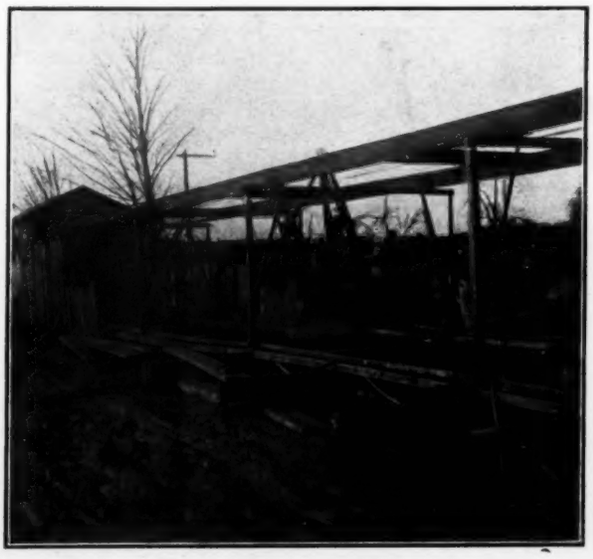
The characteristics and horsepower requirements of rock crushers, air compressors, concrete mixers and hoisting machines were given in a previous article. Data on additional machines are given in the following paragraphs.

Excavating Machines.

The excavating machine shown in Figs. 1 and 2 is commonly used in sewer construction. The car and its hoisting equipment were operated by means of a 60-horsepower double-drum electric hoist located in the shed on the left side of the illustrations. The cycle of operation was as follows: The winding drum, connected to the steel rope running the entire length of the framework, around a sheave at the far end and attached to the traveling car, was locked in position when the traveling car was at the near end. The brake on the second winding drum which raises and lowers the buckets, was released after the locks on the bucket ropes had been opened, and the buckets lowered to the bottom of the trench. The hoisting ropes were unhooked from the four empty buckets and attached to the loaded buckets. The second winding drum hoisted the buckets to the proper height on the car, after which they were locked in position. The clutch on the second drum was then opened, and the first drum drew the car to the far end of the framework where the buckets were dumped. The clutch on the first drum was then opened and the second drum drew the car back to the place where more loaded buckets were waiting to be removed.

The car travels at a rate of 400 feet per minute. When loaded, the buckets weigh 6000 pounds and are hoisted at a speed of 100 feet per minute. The hoist is also used for drawing the sheet piling and moving the entire equipment ahead. Electricity was supplied by a line run on poles parallel to the trench. At every third pole was a Sach box connected to the line. A 200-foot length of rubber-covered wires connected the Sach box to the panel in the shed. A motor-





Figs. 1 and 2—Electrically Operated Excavating Machine As Used in Sewer Construction.

driven concrete mixer and centrifugal pump were connected to the panel, the wires being run in flexible conduit.

The traveling bridge shown in Fig. 3 and used on the New York State Barge Canal is a good example of a very large excavating machine operated by a number of large electric hoists and winches. The motors and their functions are as follows: Four hoisting motors, 80 horsepower each; two trolley motors, 30 horsepower each; four motors for moving bridge, 30 horsepower each. Direct current was supplied by a 500-kilowatt motor-generator substation installed on the car connected to one of the towers.

Electric Shovels.

Electric shovels are finding favor among contractors as a result of their ruggedness and low unit operating cost. However, as there are a great many steam shovels in general use which are in good condition and which go from job to job and also on account of the high first cost of a shovel, it cannot be expected that the electric shovel will supersede the steam shovel for some time.

Electric shovels are commonly found on large tunnel work and in localities where fuel or suitable water is difficult to obtain. The small shovel shown in Fig. 4 is operated by a 25-horsepower induction motor, the hoisting, swinging, thrusting of boom, and traveling forward of car all being accomplished by the operation of clutches connecting the various mechanisms to the motor-driven shaft. Fig. 5 shows very clearly the motor drive operating the thrust boom of a small shovel digging earth and unloading it on to wagons.

The electric shovel shown in Fig. 6 is making an earth cut and is loading the loose material on to the cars on the motor-operated inclined railway. The shovel has a capacity of 2.5 cubic yards and was formerly steam operated. Slip-ring motors were substituted for the engines. Each motor is controlled automatically. The operator merely closes and opens the control switches. The control system accelerates the motors rapidly up to their maximum allowable load and inserts resistance in the rotor circuit of any motor becoming stalled, thus preventing serious motor trouble and short-circuits. The motors are of the following capacities: Hoisting motor, 115 horsepower; thrust motor, 50 horsepower; swinging motor, 50 horsepower. The momentary peak load was 250 kilowatts and the average load, 125 kilowatts. It is perhaps unnecessary to state that there should be ample generating and transmitting capacity behind such a load as this one.

Electrically Operated Pumps.

Of all the various kinds of contractors' machinery, pumps are most frequently met with. The small building contractor uses a 50-gallon-per-minute pump for keeping the cellar which he is digging free from surface water. The sewer contractor requires a much larger pump to keep his trench dry. The bridge builder needs pumps to free of water the cofferdams for the bridge piers. The contractor digging an important waterways requires a large pumping plant of several units. In addition to being used for drainage, pumps are utilized in the moving of solid materials by means of the hydraulic dredge and by the process of hydraulice sluicing. The supply of water for any large and important work is generally pumped.

Although the piston-type pump is more efficient than the centrifugal for most working heads, it is but little used for this class of work on account of its high cost, relatively small capacity, limited uses, and large maintenance cost. The centrifugal pump contains no valves and no rubbing surfaces except when the shaft touches the bearings. The clearance between the runner and the casing permits of the passage of solids of limited size without damaging the pump.

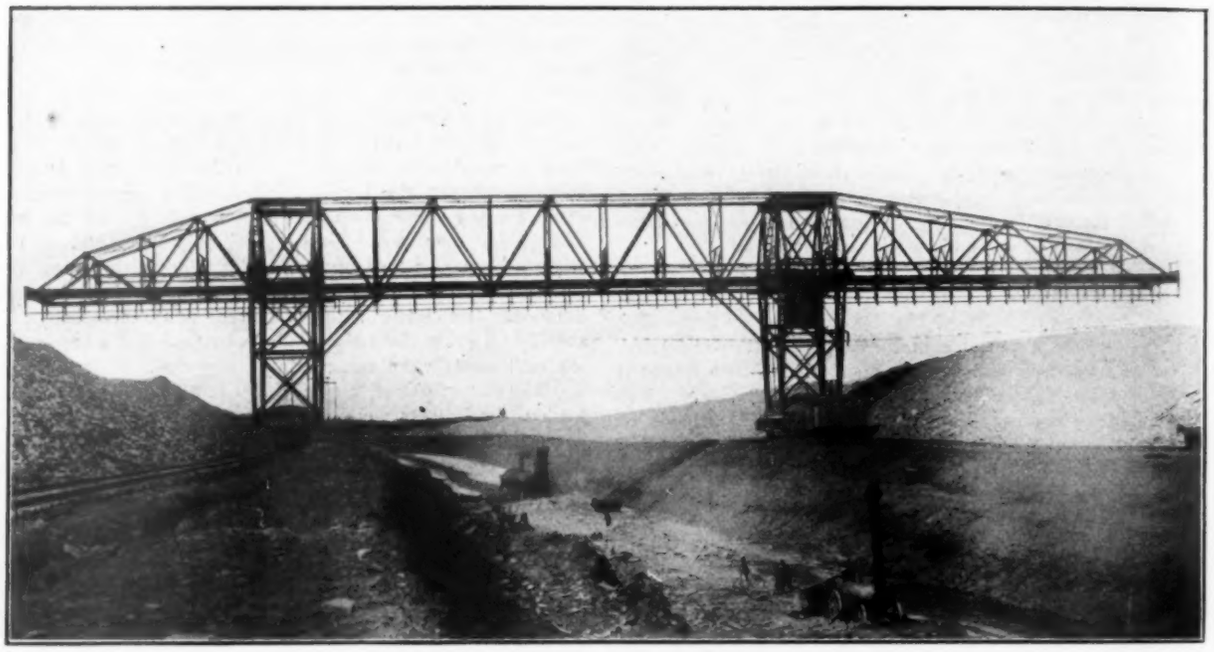


Fig. 3.—Electrically Operated Traveling Bridge for Canal Excavation.

The following radical differences between piston and centrifugal pumps should be noted. The centrifugal pump is very sensitive to speed changes. For any particular lift, there is one correct speed for each size and make of pump. If the speed is somewhat low, the capacity will be greatly decreased. If it is much lower, there will be no flow of water from the pump. If the speed is above normal, the flow will have been greatly increased with more than a corresponding increase in driving power. The piston pump is a positive-pressure pump. For a fixed capacity the speed is constant regardless of the head and the power input is nearly proportional to the head. On the other hand, if the head on a centrifugal pump, which is running at constant speed, is increased the capacity and power required will be reduced, and if the head is decreased, the capacity and power used will have increased. The centrifugal pump will not suck air; the piston type will.

The following points should be observed in installing a centrifugal pump. The total head should first be determined.

Fig. 4.—Small Electric Shovel Operated by a 25-Horsepower Motor.

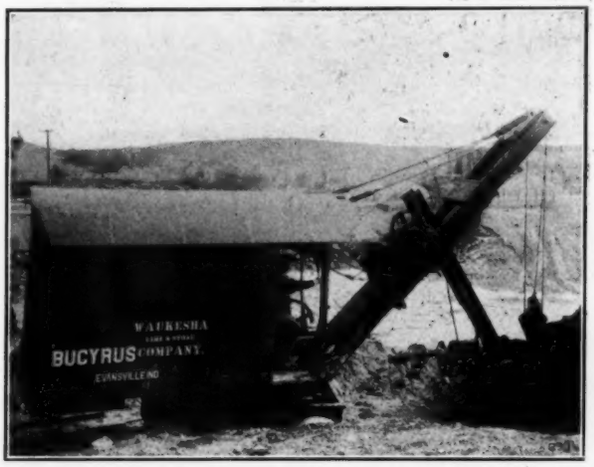


Fig. 5.—View of Motor Operating Thrust Boom of a Small Shovel Digging Earth and Unloading It Onto Wagons.

Fig. 6.—A Converted Steam Shovel Unloading Onto a Motor-Driven Incline Railway.

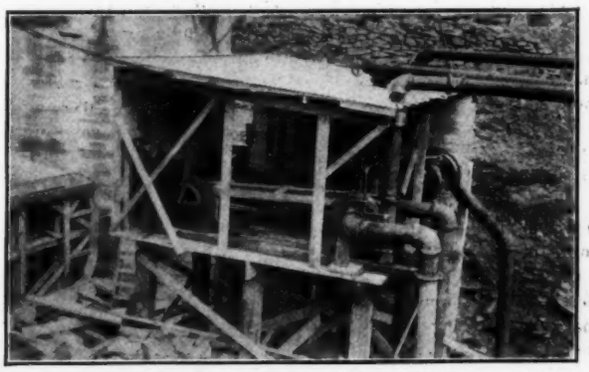


Fig. 7.—Battery of Three 2000-Gallon Centrifugal Pumps Each Operated by a 25-Horsepower Motor.

Fig. 8.—Motor-Driven Pump Installed Midway Between Top and Bottom of a Cut to Avoid Excessive Lift.

Fig. 9.—An Economical Method of Draining an Abandoned Quarry. The Motor-Driven Pump Was Installed on a Raft.

Fig. 10.—Motor-Operated Dredge.

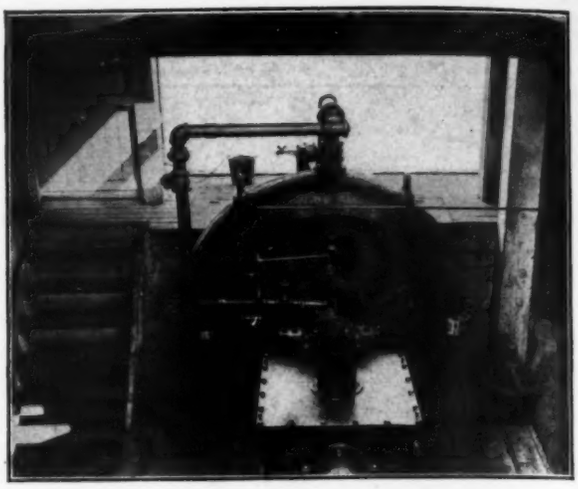


Fig. 11.—Motor-Driven Dredge Pump.

The manufacturer's bulletin should give the proper speed and horsepower for this head. As this pump is not self-priming, some means must be provided for filling the pump casing and suction pipe full of water before starting the motor. If there is air in the pump or suction, the pump will not lift water. If, after the pump has been successfully started, air leaks into the casing or suction pipe, the discharge of water will stop. It is necessary that the pump and suction piping be air tight. Hose should not be used on the suction on account of air leakage in the hose and joints. The pump can be primed by means of an ejector, in which case there must be a valve on the discharge side of the pump which is closed when priming and starting. The suction lift should be as low as possible, and in any case not over 25 feet.

The ordinary single-stage, single-suction pump has an efficiency of about 50 per cent. Its capacity in gallons per minute is approximately equal to the product of the square of the diameter of the discharge opening in inches and 30. For example, a pump having a 10-inch discharge will have a capacity of 3,000 gallons per minute for $(10^2) \times 30 = 3000$. The required horsepower can be easily calculated from the weight of the water and the total head.

Although there are many more horizontal-type centrifugal pumps in use than those of the vertical type, the latter type is preferable when it can be completely submerged, thereby eliminating priming. The direct-connected, motor-driven vertical type is most convenient for draining a deep shaft or pit. The pump is lowered as the water level falls. In order to pump against the increasing head, the pump, must be speeded up. Another method is to keep the head constant by means of a valve on the discharge pipe. As the pump is lowered, the valve is opened so that the additional lift is offset by the reduction in valve friction.

The battery of three 2000-gallon-per-minute centrifugal pumps (Fig. 7) were driven with three 25-horsepower induction motors. They were used to keep drained a large excavation on the bank of a river where the seepage was unusually high.

The large pump shown in Fig. 8 was installed midway between the top and bottom of the cut as it would not have been possible to have had a suction lift as great as the total depth of the cut. On the other hand, the motor was installed at the top of the bank in order to secure a good belt drive at minimum cost.

Fig. 9 shows an unusual but economical method used to drain a large abandoned quarry. In order to have as short a suction lift as possible the pumping equipment was mounted on a raft. As it was necessary to move the raft toward the center of the pond as the level was lowered, a very long discharge pipe was required, the ends of which were supported only at the raft and the top of the bank. Double-braided rubber-covered wires were run from the temporary transformers and meter installation on the pole through the water to the motor.

Electric Dredges.

Large quantities of electric power are used on suction dredges. The dredge shown in Fig. 10 has a total motor horsepower of 1050. The principal machinery consists of a

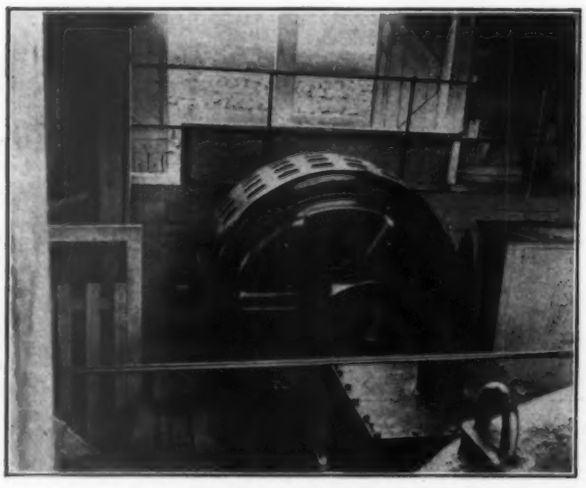


Fig. 12.—700-Horsepower Pump Motor.

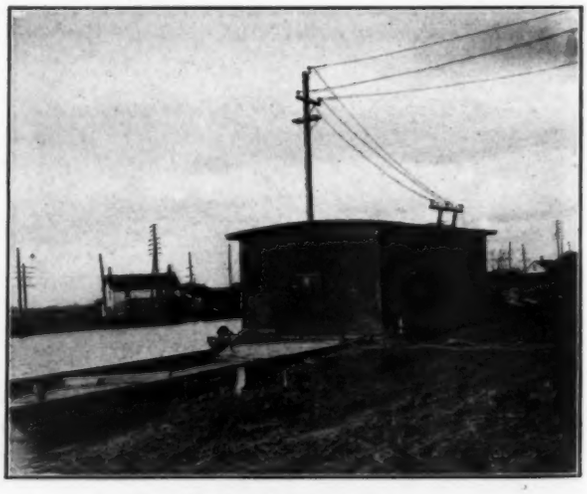


Fig. 13.—Transformer Barge.

20-inch centrifugal dredging pump (Fig. 11) direct-connected to a 700-horsepower adjustable-speed slip-ring motor (Fig. 12), a cutter driven by a 200-horsepower motor, and a 75-horsepower motor driving the hoisting machinery. Electricity is supplied to the dredge by a 16,000-volt line paralleling the work. Sliding contact is made with the conductors by means of three metal shoes mechanically fastened together with insulating material. These "shoes" are electrically connected to the transformer barge as shown in Fig. 13. Electricity is stepped down to 2200 volts and is supplied to the motors at this voltage behind the dredge. A 20-inch pipe line, of considerable length and floating on pontoons, carries the mixture of water, earth, and stone into low lands near by. The discharge from the pipe is approximately 12,000 gallons per minute.

Fig. 14 shows how a steam engine lost its job. The original equipment was a 25-horsepower engine direct-connected to an eight-inch centrifugal pump used on various parts of an excavation contract. Due to the difficulties involved in supplying a portable pump with stream from a stationary boiler plant, a 30-horsepower electric motor was installed on skids common to both machines and belted to the engine flywheel. After the connecting rod had been removed the equipment was ready to run. The simplicity of the installation as well as the small expense incurred should be noted.

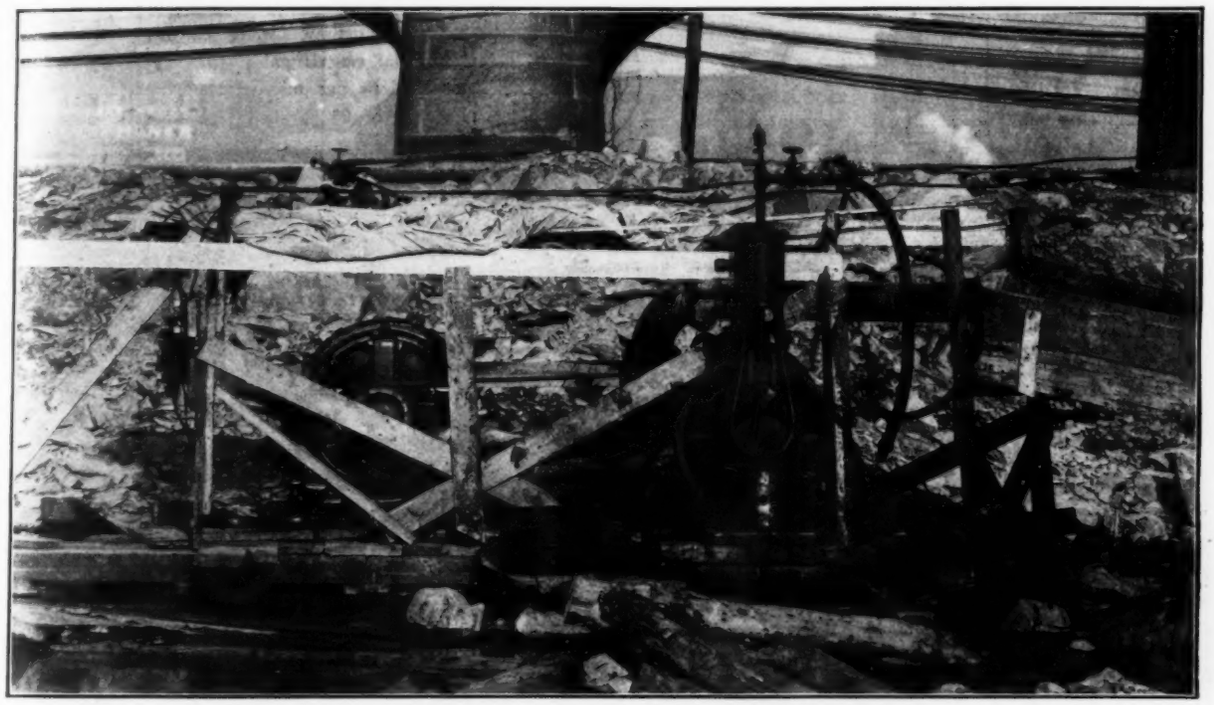


Fig. 14.—A Dismantled Steam Engine Replaced by Electric Motor.

A pumping plant requiring 200-horsepower was recently installed to drain a very large and deep cut. The equipment consisted of three 10-inch and one 8-inch centrifugal pumps with a total capacity of 11,000 gallons per minute. Two weeks of 24-hour per day operation were required to drain the excavation, after which time but part of the apparatus was used to remove the spring and surface water.

Society of Terminal Engineers.—The first regular meeting of the recently organized Society of Terminal Engineers was held in New York, in the United Engineering Societies Building, on May 29. Special papers on terminal engineering and mechanical freight and material handling were read. Committees were appointed and a program adopted for the future work of the society.

ADVANCE RESULTS OF "WIRE YOUR HOME TIME."

Records Show that Over $100,000 Were Spent in Advertising During the Campaign.

Reports that are reaching the Society for Electrical Development daily indicate that although the specific dates for "Wire Your Home Time" have passed, the work has received an impetus that will carry well through the summer.

An intense interest was shown in the $1250 contest by contractors and central stations, and indications are that the estimates of 50,000 house-wiring contracts has been equalled at least. The Society's staff is busy sorting out the reports, and announcement of the winners may be expected by June 15 at the latest.

The interest in the campaign was not confined to any single section. Almost every State was represented, and the smaller cities were especially strong in the number of contestants. It is especially gratifying to report that the plans of the Society were followed in most places with slight modifications to fit the local conditions, regarding relations with electrical contractors, etc.

The results of this campaign far exceed those of the campaign last year in the face of the fact that business was good before the campaign started. High prices did not seem to hold back the orders, and it is interesting to note that salesmen did not stop with the wiring contract, but, in many instances when the wiring contract was signed, placed an order for one or more electrical appliances to be installed when the wiring was completed. In some instances it is reported that wiring contracts were secured because of the appeal made by some needed appliance.

The activity and interest of the contractors and central stations is clearly shown by the amount of advertising space purchased in the newspapers. To date the Society for Electrical Development has on file clippings of advertisements totaling 54,000 column inches of "Wire Your Home Time" display advertising, the estimated value of which is fully $100,000.

Reclamation Pumping a Profitable Power Load

North Coast Power Company Serves 5000 Acres with Total Load of 415 Horsepower—Steel-Conductor Transmission Lines Are Used

By RICHARD M. BOYKIN.

Consulting Engineer, North Coast Power Company.

THE North Coast Power Company, Portland, Ore., furnishes electric power to three reclamation projects; one near Gaston, Ore., with 180 horsepower connected, and two at Kelso, Wash., known as Diking District No. 1 and No. 2, with 235 horsepower installed, or a total of 415 horsepower reclaiming approximately 5000 acres of very rich land.

The Gaston Project.

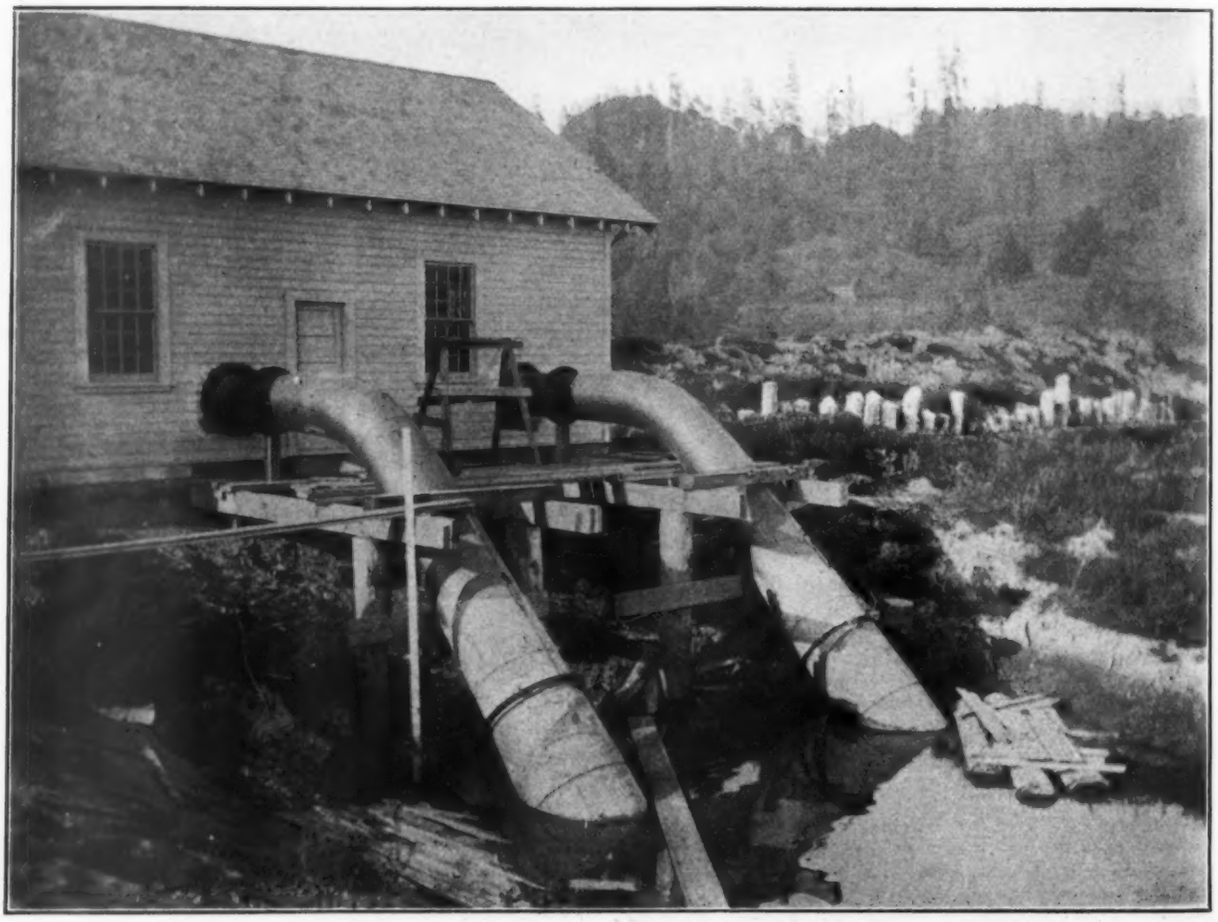
This project is owned by Ex-Governor Miles C. Moore of Walla Walla, Wash., and contains 800 acres of land formerly the bed of Wapata Lake—a more fertile tract does not exist.

Beavers are said to have dammed the Tualatin River, forming the lake, although there is no remaining evidence of this. The river has little fall and the heavy winter rains cause the bottom lands to be subject to over-flow, and in many places the waters do not leave until too late to plant crops. Wapata Lake is in reality lower than most of the valley and ordinarily the water would not entirely disappear until late in August.

Canals and ditches were dug through the lake in summer, and the waters were led to a pump near which was built a dam and sluice gate to prevent the back water from entering the lands during the pumping season each spring.

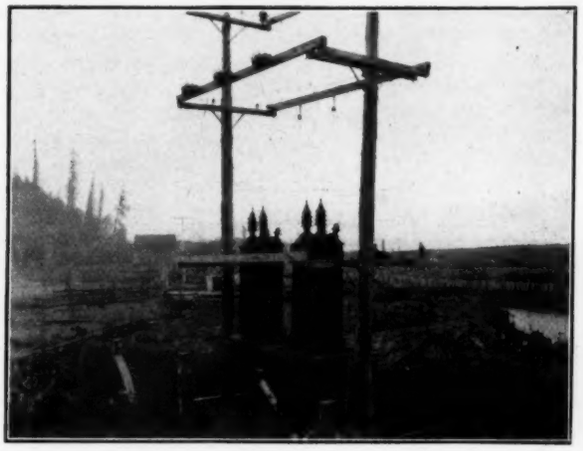
A 30-inch vertical centrifugal pump, having a rated capacity of 40,000 gallons per minute, at 8-foot head, with a guaranteed efficiency of 65 per cent, has been installed in a suspended steel frame and connectetd to a horizontal 180-horsepower, 2,200-volt, General Electric Company, 3-phase, synchronous motor, through the means of a bevel gear and pinions.

The head varies from a few inches to a maximum of approximately two feet, which occurs at the end of the pumping season, which lasts about two months. The back water



Intake Side of Pumping Station at Western Reclamation Project.

Transporting Transformer Under Difficulties for Reclamation Service.



Typical Transformer Installation for Pumping Plant. Steel-Conductor Transmission Lines Are Used.

outside the dam falls very much slower than the water is discharged by the pumps.

The North Coast Power Company's 3-phase, 22,500-volt transmission line through Hillsboro and Forest Grove supplies power to the installation, through two 50-kilowatt transformers of the outdoor type.

The energy charge is at the Power Company's tariff, as follows:

3.5 cents per kilowatt-hour for the first 30 hours' use of demand.

2 cents per kilowatt hour for the next 60 hours' use of demand.

0.008 cent per kilowatt-hour for all excess consumption.

In case of operation during the peak period, $1.25 per kilowatt of demand is charged. The demand is measured during a five-minute time interval.

The highest demand thus far recorded is 78 kilowatts and the cost to the owner for pumping per acre is approximately $1.65 per year.

Five hundred acres were cultivated last season, and while complete data on the crop raised are not available, it is known the results were highly satisfactory to the agriculturist. Forty acres of flax produced 1,000 bushels of seed and sold for $26.50; the flax straw being unfortunately rendered useless, due to tangling in the threshing operations.

Under normal conditions 75 acres produce 150 tons of flax straw. After retting the straw, 30 tons of fiber will be left, and the market value of the fiber is between $780 and $1,000 per ton, depending upon the quality. It is said the best flax in the world is produced in the Willamette Valley, and on the basis of $780 per ton, the yield of fiber would be $23,400 or $315 per acre. From 75 acres in buckwheat the yield was 1,700 bushels, valued at $1,900.

Little is known of the retting process in this country, but Governor Moore and the Portland Chamber of Commerce are interesting those who do know the process to install a plant at Gaston and it is the hope and aim of Governor Moore to have such a plant established, and also some manufacturing enterprise to utilize the fiber. Real work has been done in this line, and it is hoped an announcement can be made soon of the beginning of a plant to ret and manufacture flax fiber products, at Gaston, Ore.

How Diking Districts Are Formed.

There are two reclamation districts near Kelso, Wash., organized under the diking laws of the state of Washington, and they are in reality municipal corporations.

It will probably be of interest to state how these districts are formed and organized.

A petition, containing the names of all the free holders, the acreage to be benefited, the boundary and the general plan of the proposed improvement, is presented to the County Commissioners, signed by the owners of a majority of the acreage. This petition must be accompanied by a $500 bond to pay the expense of the election, in case the voters turn the project down, and the bond is returned if the election is carried.

The County Commissioners cause the petition to be published, fix a date for a hearing, and if at the hearing it is deemed advisable by the commissioners, they order an election held in the district to ascertain if the district shall be organized and to elect diking commissioners, who shall govern the affairs of the district.

The general election laws govern the election, no one residing in the district for less than 30 days being allowed to vote, and if the majority of the votes past favor the plan, the project is put through.

Three commissioners govern the project and are vested by law with considerable power. They are empowered to dike, maintain and operate their districts, can change navigable streams flowing within their area, can dig canals within and without their districts, have the power of eminent domain and can sue and be sued.

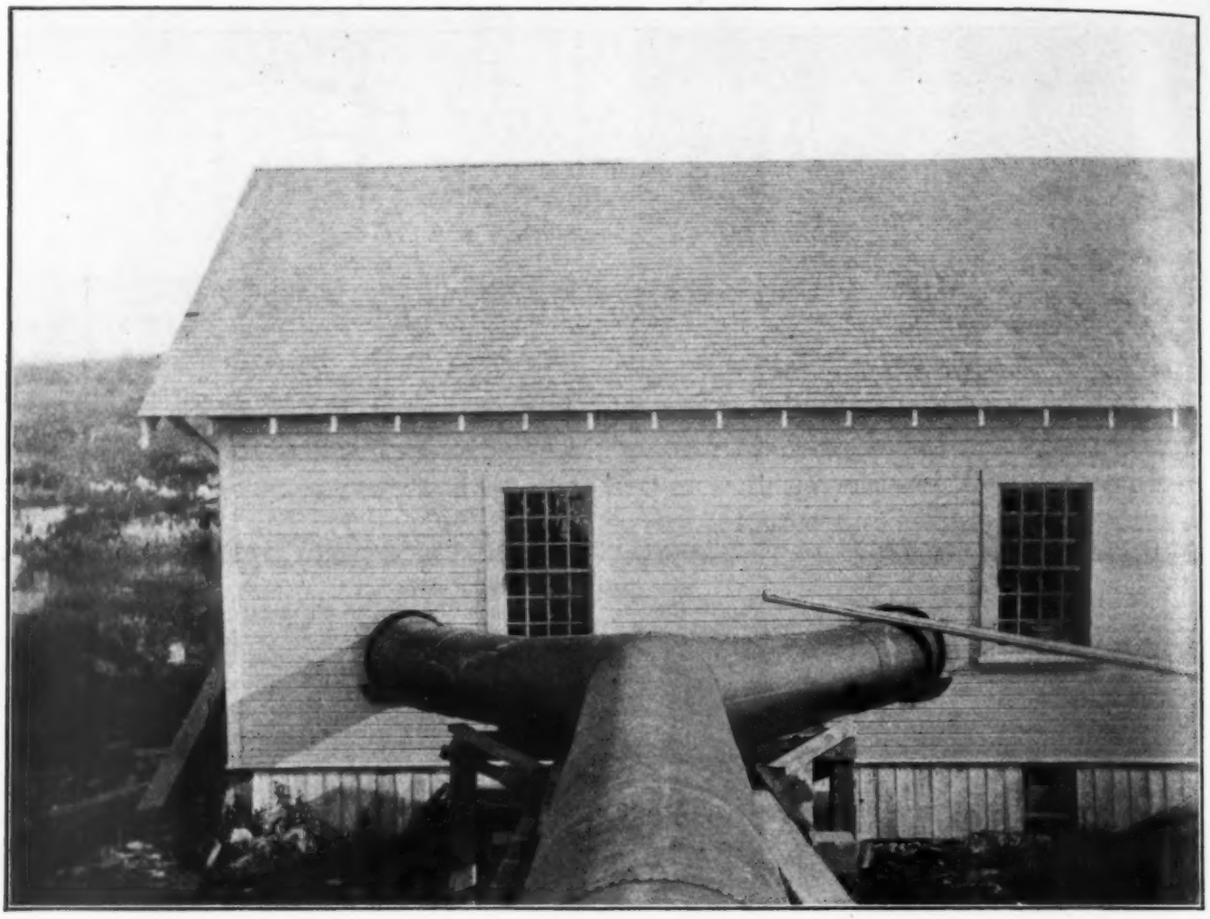
Plans are required to be filed with the officers of the Superior Court with estimates of the work the commissioners are to undertake; it being also necessary to show the extent of damage and benefit per acre for each property owner of the district.

The Diking Commissioners, by resolution, can cause 10-year bonds to be issued to the full estimated cost of the project. The bonds may be given in payment for contract work, but if sold must not be below par and to the highest bidder. The interest rate the bonds carry is fixed by the commissioners and the bond is a promise to pay by the diking district. The bonds issued for the districts already under reclamation have proved to be in good demand.

The commission fixes the assessment on the property to pay interest and sinking fund on the bonds and for the maintenance of the dike. The country treasurer collects the assessment and acts as disbursement officer on order from the Commissioners.

Diking District No. 2.

This district, containing 1,300 acres of tillable land, lying between the Cowlitz and Coweman Rivers, was the first to dike, and when the project was almost completed the commissioners began to investigate power sources. The commissioners, with the exception of one, were prejudiced against electric drive, thinking it was too expensive, unreliable and dangerous. All sources of power were investigated, includ-



Discharge Pipes, Leaving Pumping Station, Fed by Two 18-Inch Motor-Driven Centrifugal Pumps.

ing the Diesel engine, but each had its disadvantages, the chief being the high original cost of installation, cost of attendance and maintenance.

A long-term electric power contract was finally signed by the commissioners, at the same rates mentioned in the Gaston project, with a minimum charge of $9 per year per horsepower connected. The commission furnished the conductors, No. 4 copper, and hardware from the power company's substation in Kelso, one mile and a quarter to the pumping station, which is on the power line of the company.

In the pumping station are two 18-inch centrifugal single-stage pumps, one belted to a 50-horsepower and the other directly connected to a 35-horsepower motor. These pumps operate against heads varying from a few inches to 15 feet, depending upon rain fall and stages of the Columbia River. The maximum demand has been as high as 80 kilowatts and the first year power cost per acre of agricultural land was $1.45.

The cost of the project was $60,000 or $46 per acre of agricultural land. The dike contains 394,000 cubic yards and was placed in the dike for $0.0784 per cubic yard, which is a very low figure.

Prior to diking, the assessed value of the land was $2.50 per acre and it is now $45 to $160 per acre.

Diking District No. 1.

The next district to take advantage of the reclamation law in Gowlitz county is known as Diking District No. 1, and has 8,600 acres in the water shed and 2,750 acres of agricultural land.

These lands are along the Columbia River and west of Kelso in the Mount Solo and Coffin district and each day they are covered by tides and in early summer 10 to 13 feet deep with flood waters from the Columbia River. It is only during August and September that the lands are dry and then can be used only for grazing.

The diking along the Columbia River is for a 30-foot stage at Portland, which corresponds to approximately 14 feet 40 miles below.

This district was bonded for $99,000 and the cost of the completed work was $68,000 or $24.75 per acre for the agricultural lands.

This district presented a more difficult problem for electrification than either of the two described before. The location of the belted, 24-inch centrifugal pumps, requiring 150 horsepower, necessitated 6.63 miles of line. The line had to be built partly along a freshly constructed, soft, muddy dike and through the marsh tide lands.

The expense of construction and consequently heavy investment and the probability of not sufficiently long pumping periods to produce the revenue to warrant the investment, made the central station hesitate for some time before soliciting the business.

The run-off, rainfall, evaporation, percolation and tides had to be reckoned with to determine the amount of pumping that would be required. Using available data, it was thought $2500 to $3000 per year would be the gross revenue, which was sufficient to warrant the building of the line. As the diking progressed, however, the owners of adjacent marsh lands became very much interested in reclamation, and before the end of 1917 the company confidently expects about 8000 acres will be placed under dike, that will be supplied with power from the same line. The calculated revenue was 50 per cent overestimated, due to a rather unexpected quantity of the drainage being taken out through automatically operated

tide gates. However, with the added acreage under dike, the revenue to be derived will make the line a profitable investment.

How Business Is Secured.

Upon deciding to solicit the business of this district, great difficulty was encountered in obtaining it, due to the energetic work of the oil-engine salesmen and to the lack of knowledge of the Commission on electrical matters. The terms in the contract were not understood and they demurred against securing right-of-way for the line and advancing a portion of the building capital, which was to be returned in monthly payments of 30 per cent of the monthly bills, but not to apply upon the minimum charge.

Fortune smiled upon the company in the survey for the transmission line, which was done when the country was frozen early in 1916, otherwise the cost would have been high, on account of the soft, boggy ground. The cost of the survey and detailed maps and plans of the line was $28.50 per mile. When the preliminary estimate of the cost of building the line was made, it was decided to use No. 6 copper, the price then being 20 cents per pound. By the time orders were to be placed for the material, copper had advanced to 27 cents and No. 6 could not be had.

The pole spacing is now 300 feet, with one-fourth inch, seven-strand, No. 14 double-galvanized, low-strength steel for conductors, and No. 9 B. B. telephone wire for ties. The line is designed to carry 225 kilowatts, with 5 per cent drop at 22,500 volts, but later the voltage will be doubled and the line extended some eight miles, for another load of somewhat the same character, down the river.

The highest load on this steel-conductor line has been 135 kilowatts, but will be 270 kilowatts when the added acreage is inclosed by the dike, at which time tests will be made to determine the voltage drops and power lost. The conductors have 48 inches of sag at 70 degrees temperature, giving ample factor of safety for the climatic conditions on the Columbia River so near the mouth.

Considerable trouble was experienced in making the line calculations when the impedence in ohms by virtue of the skin effect of the steel had to be reckoned with, and my inquiry for information was the result of considerable research and experimental work at the Oregon Agricultural College and elsewhere in the use of steel conductors on voltages of 6600 and upward at 60 cycles.

FLOOD LIGHTING OF THE FEDERAL CAPITOL.

Permanent Installation of Projector Lighting for the Dome and Facades of the Capitol Building.

Against the somber shadows of night, at this critical moment in our history, the inspiring white dome of our Capitol at Washington, high above the Federal City, stands resplendent in rays of shining light—a radiant monument to freedom and democracy. The plans for illuminating the Capitol dome were perfected for the recent inauguration of President Wilson and the spectacular results were so satisfactory that the system has been made permanent.

Flood lighting was the method used to illuminate the great dome, which is 135 feet in diameter at the base, 218 feet high above the roof, and is surmounted by a bronze statue of "Freedom." Eighty-four form L-1 General Electric flood projectors, each equipped with a 400-watt Edison Mazda C flood-lighting lamp, were used. These projectors were placed in four banks, located about 200 feet from the dome, on the corners of the House and Senate wings. By placing the projectors in these positions it was possible to throw the

Night View of the Flood-Lighted Capitol at Washington, D. C., as Seen from Pennsylvania Avenue.

light from different directions on the 36 columns at the base (representing the 36 states in the Union at the time the Capitol was designed) and thus eliminate excessively dense shadows. Some shadows are desirable to bring out the architectural beauty, but if the shadows are too pronounced they become objectionable.

The building proper was also lighted to a low intensity, to form a setting for the dome and to relieve the contrast between a very light dome and a dark building. The building is about 750 feet long and 250 feet wide. The central portion, or main building, is of sandstone painted white, and the House and Senate wings at the ends are of white marble. Surrounding the building on three sides is a wide concourse bounded by a parapet. Thirty-four form L-3 G-E flood-lighting projectors, each equipped with a 400-watt Edison Mazda C flood-lighting lamp, were mounted on the ornamental posts that are placed on this parapet. These posts were originally designed to take large opal globes. Most of these globes were removed and blocks of treated wood were placed in the fitters to which the projectors were bolted. Thus the projectors are rendered comparatively inconspicuous and do not detract from the natural architectural features around the building.

This illumination has attracted a great deal of attention and favorable comment not only from residents of Washington, but from the thousands of visitors from all parts of the country and from abroad. Foreign visitors have particularly remarked on the very striking contrast between this flood-lighting and the opposite practice followed in the European capitals of reducing the outdoor lighting to a minimum.

Domestic Installation Campaign at Glasgow.

Glasgow municipality has before it a proposal to secure the fullest possible use of electricity for domestic lighting, heating, and cooking, in connection with measures which are contemplated for housing improvements in the city. Those engaged investigating the housing problem are to be urged to substitute electricity for other means wherever possible, and the architects who have been engaged to town-plan the city are to be appealed to similarly. The Dean of Guild and his Court may also be desired to exercise their influence and authority to secure in new buildings wiring of sufficient size and capacity to permit, in addition to lighting, the installation of heating and cooking appliances.

VALUE OF ELECTRIC VEHICLES FOR IMPROVING LOAD CURVE.

War Condition Will Probably Emphasize Advantages of Battery-Charging Business.

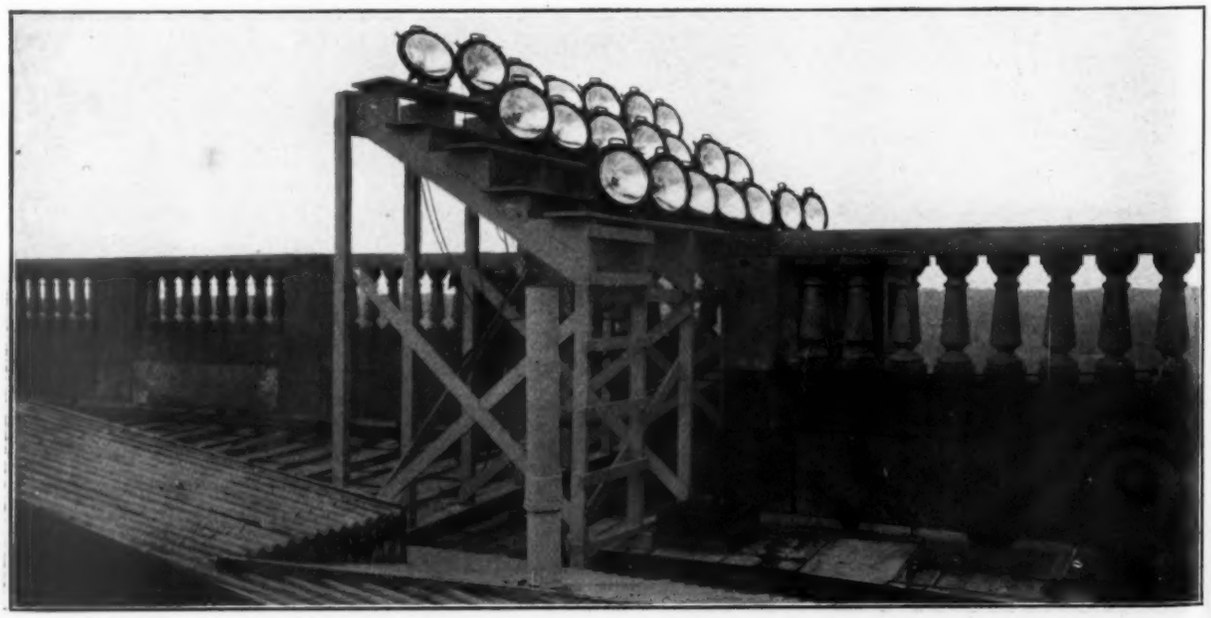
The war, with its attending conditions, places the electric vehicle at an especially desirable angle from the central-station point of view. Since belligerent circumstances may tend to cut down the amount of new business which ordinarily is taken on, the probable increased use of the electric vehicle, particularly for urban transportation, would offset this loss by the large amount of off-peak business. The electric-vehicle-battery-charging load is not only off-peak, but occurs during what may be called the negative peak period, and for this reason is the most effective load possible for straightening out the load curve.

The following statement, which was made by W. P. Kennedy at the recent central-station conference held under the auspices of the Electric Vehicle Section, National Electric Light Association, is suggestive of the load value in a number of our large cities which could be secured by adequate exploitation. In 14 large cities there are 432,814 horses which could be replaced by electric vehicles, thereby providing the central stations with a load having a value of $43,281,400 annually.

The possible commandeering of a large number of gasoline-truck drivers for service abroad would necessitate the training of new drivers here. With the present scarcity of available men, the electric vehicle, with its extreme simplicity of operation, offers a solution of this problem. In contrast to the complicated gas engine and the constant shifting of levers necessary, the electric can be operated with the minimum amount of physical exertion, and thus affords the ideal transportation vehicle, which in many cases will be driven by women. The present gasoline situation is an added problem to transportation since petroleum is needed in tremendous quantities for the operation of the Allied ships, and the production is rapidly decreasing.

Thus the electric vehicle apparently enjoys a most auspicious moment and an unrivaled opportunity to prove its worth.

Associated Employees of the New Orleans Railway & Light Company.—At a recent meeting of the Associated Employees of the New Orleans Railway & Light Company E. N. Avegno was elected president for the coming year.



Day View of a Bank of Flood-Lighting Projectors on the Roof of the East Wing of the Capitol at Washington.

Notes on Commercial Practice

New-Business Methods, Policies, Rates and Kindred Central Station Matters for the Man Engaged in Selling Electricity

War Leads to Increased Use of Electrical Appliances.

That war conditions causing high commodity prices and a scarcity of labor will probably lead to increased use of household electric appliances is the belief of a writer in *Printers' Ink* of May 3:

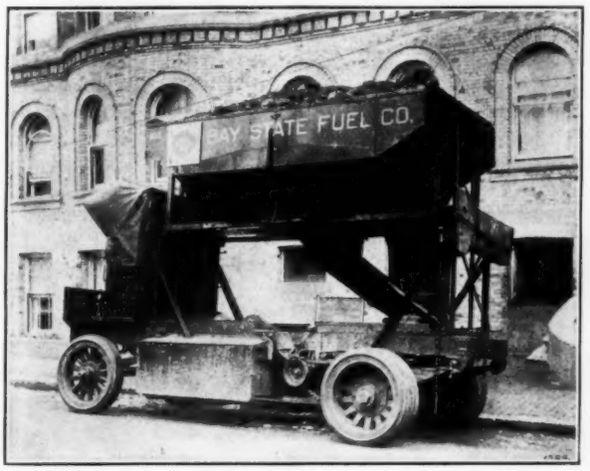
"Aside from the fact that the luxuries of yesterday are the necessities of today and that countless thousands will refuse to go back to hand pumps, brooms and tallow candles, war or no war, there is the circumstance that certain consequences of war will tend unmistakably to advance some luxuries into the class of indispensables. Take, for example, the probable consequences of the shortage of labor that is almost certain to result. With the domestic-servant problem cocm plicated and the mistress of many a home virtually compelled to do her own housework, when she could afford to pay the salary of a maid, it is a fair guess that there may well be an increased demand for dish-washing machines, fireless cookers, vacuum cleaners, electric irons, automatic hot-water heaters, sewing-machine motors and a dozen and one other labor-savers for use in the home. Nor should the fact be overlooked that many housewives who have within the past year been impelled by the high prices of foodstuffs to rearrange their domestic organizations, perhaps dispensing with or curtailing the amount of kitchen help, are just now discovering that they can afford to purchase, out of their newfound savings, some of the improvements in household equipment long coveted but heretofore regarded as extravagances. Furthermore, some advertisers—say, advertisers of electric specialties, aluminum cooking utensils, etc.—are destined to find that many women are willing to purchase for their own use, articles which, by reason of the price, they will not purchase for the use of a servant."

Electric Vehicles Lower Cost of Coal Delivery.

In England during the early part of this year there were several weeks of extremely cold weather, which exhausted the fuel in nearly all of the coal cellars and caused a run on the merchants who supply poor customers with coal in small quantities. According to the London "Electric Vehicle," this coal shortage had not been anticipated, and while it was not, strictly speaking, a coal famine, there was such a scarcity of horses and men that there were not ample means of transporting the coal to the users, thus causing considerable discomfort and misery. "Snow and frost produced a road surface which was as good as fatal to horses. Then began a most inglorious scramble for hundredweights and even pounds of coal. Perambulators, hand-carts, taxicabs, and all sorts of things were pressed into service. It is easy to dismiss such a deplorable crisis with the remark that it was owing to the war. But it was not entirely owing to the war. The war merely showed up the weaknesses of a system which had come down from generations ago.

"A leading London coal merchant states that three journeys formed the average day's work of a man with a coal cart. Four journeys could be done if the man hustled; but with the contrariness of the independent workman, he was more inclined to do two instead of three or four, while every household was clamoring for deliveries.

"The maximum capacity of a coal cart is about two tons, so that the average performance of a horse and cart is six tons per day. The system of distribution is wasteful, because a horse and cart and a man have to be maintained for the transport of a few tons of material at a crawling pace for a mile or so.



A Five-Ton Electric Coal Wagon Used in Boston.

"If, instead of depending upon horse traction, we had been provided with mechanically-propelled vehicles of much larger capacity, the coal famine would never have occurred. To anyone who argues that we should have been almost as badly off with petrol wagons, because of the restrictions on petrol, the lack of skilled drivers, and the difficulty of running heavy petrol wagons on ice-bound roads we would offer no denial.

"The conditions are, in fact, eminently suited to electric haulage. No power is used except when the vehicle is running; skilled drivers are not required, so that the carter can be driver as well; and the vehicle is ready for the road at any time under all conditions of surface. The limited radius of delivery—a feature which tells against the economical use of petrol or steam wagons—is favorable to the most economical use of battery vehicles."

Electric trucks have already been used in England for the transportation of coal from depots to electric power stations and to other large users. A three-ton electric coal truck used by a Glasgow firm works 307 days out of 865, and was out of commission only one afternoon and the following morning during one entire year, thus attaining a reliability coefficient of 99.65 per cent.

The value of the electric truck for coal delivery has been appreciated in this country for a number of years, and especially in New England, where there are many large fleets in operation. A novel electric coal truck is used by the Bay State Fuel Company of Boston. It is a five-ton truck with a body which can be hoisted on four heavy screw pins, and is adjustable to any height up to its limit of 39 inches, so that the coal can be conveyed by chute not only across the sidewalk, but across the average lawn. All operations, lifting or

lowering, are controlled from the driver's seat, and the two-horsepower motor, located in the rear of the chassis for this purpose, is able to lift 5.5 tons of coal in 1.5 minute, using only 26 amperes of current. The body may be lowered in one minute.

Just at this time the fact that a great number of truck drivers will be drafted for services abroad, the possibility of many horses being commandeered, and the increasing scarcity of gasoline makes it advisable for the coal dealer to carefully consider his transportation facilities for the coming year. Since women drivers may have to be employed to a great extent, the electric truck seems to be the natural means of transportation to adopt, because of its extreme simplicity of operation, and lack of complicated parts.

The New York Edison Company Seeks Oriental Load.

An interesting example of the thoroughness with which the New York Edison Company goes after new business is shown in the campaign which it recently inaugurated to reach the Chinese population. Letters in Chinese were sent out to more than 500 Chinese laundries in New York City and to used constantly without the trouble of changing. Electricity also operates mangles and other laundry machinery.

"If you will send the inclosed card to us with your name and address, our representative will call to tell you more about our offer. This information is free of charge."

A 22-Story Skyscraper in Brooklyn Uses Edison Service.

For years Manhattan has been the home of skyscrapers, whereas Brooklyn, "the Greater City's Greatest Borough," was conceded by all to be the sleeping place of New York and the home of churches. Such a thing as a 22-story office building in Brooklyn heretofore has never been considered practicable from a business standpoint. In fact, there has been a question in the minds of real estate men as to whether a building of this size, in addition to the present office buildings, could be rented up sufficiently well to be put on a paying basis.

During the latter part of 1916 plans were prepared and filed for a building of this size on the corner of Court and Remsen Streets, the proposed building to cost approximately one-half a million dollars. This building overtops its neigh-

Put
Electricity
In Your Home
Bright, steady light
at Reasonable cost
Decide where you would like to have lights and let an Edison man call to estimate on installing them. Send word to any of our offices listed below
The New York Edison Company
At Your Service
General Offices: Irving Place and 15th Street
Branch Office Show Rooms for the Convenience of the Public
424 Broadway
126 Delancey Street
10 Irving Place
124 West 42nd Street
151 E 86th Street
27 E 125th Street
362 E 149th Street
All Show Rooms Open Until Midnight
Night and Emergency Call: Farragut 3000

Bright Lights
Increase Business
People like to trade in a store that is well lighted. Bright lights show off goods to advantage and make a place up-to-date and attractive
Wiring takes but a short time and does not disturb the regular business of the store
Our Deferred Payment Wiring Offer
By this plan we pay all the cost of wiring and fixtures. This amount may be paid back to us in monthly sums
Information gladly given at any time
The New York Edison Company
At Your Service
General Offices: Irving Place and 15th Street
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All Show Rooms open until midnight

Two Recent Newspaper Advertisements of New York Edison Company Published in Foreign-Language Newspapers.

about 150 chop suey restaurants over the signature of Arthur Williams, the general commercial manager. A number of replies have already been received written in Chinese and requiring the services of an interpreter to make a translation. The result in connected gains is gratifying, and the outlook very promising, as a result of this campaign. The Chinaman in New York absorbs advanced civilization very rapidly and many of them have completely equipped their laundries with electricity, while others are following their example. The proprietor of the chop suey restaurant finds the electric sign almost indispensable in his business.

The letter signed by Mr. Williams is as follows:

"We are still continuing our offer for equipping laundries with electricity. By this plan our company pays for all wiring and fixtures, the cost to be paid back to us in monthly amounts.

"Electric lights are cool and convenient. Electric fans, which can be attached to lamp sockets, keep workrooms comfortable in warm weather.

Both washing and ironing can be done by electricity. Electric washing machines make clothes clean in a very short time. Electric irons always stay hot, and one iron can be

bor, the Temple Bar Building, which has heretofore been considered the tallest office building in Brooklyn, by over 10 stories.

As is usual when large buildings are contemplated, the architects and engineers took into consideration a private generating plant. The engineers of the Brooklyn Edison Company carefully considered the needs of this building, and, after many consultations, a decision was finally reached in favor of Edison Service and a contract signed for a term of years covering an equipment of 600 horsepower in motors and lights.

The steam requirements in an office building of such proportions as this have always been considered serious handicaps against a consideration of central-station service. Steam in a large quantity is necessary for heating the building, furnishing hot water and for use in the restaurant. This matter was thrashed out thoroughly by the Court and Remsen Company, with the result noted above—Edison service exclusively.

This 22-story skyscraper of Brooklyn, when completed and satisfying all of its power needs and its hundreds of lights from the mains of the Brooklyn Edison Company, will be a worthy monument to the slogan, "Edison Power Pays."

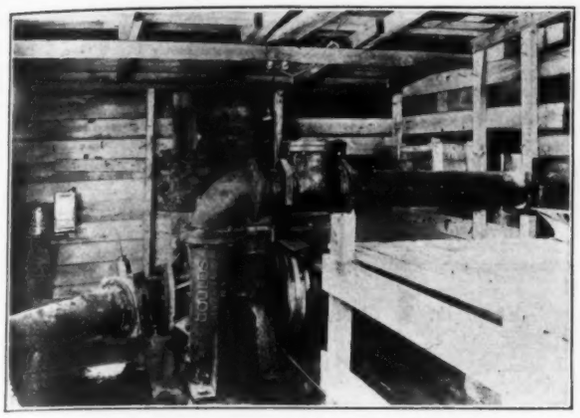


Fig. 1.—A 2000-Gallon Motor-Driven Pump.

Fig. 2.—A 500-Gallon Pump Is Installed in Shed.

Power Rates Raised by Consumers Company.

The Consumers Power Company, Grand Rapids, Mich., has already placed into effect a new schedule of rates for large users of electricity and other increases will be made for users who now receive energy below the franchise rate, as rapidly as present contracts expire.

This announcement was made by District Manager Samuel A. Freshney of the company. He explained that the increase was due to the big increases in the cost of production, and stated further that if the increases continued, the company may be forced to ask an increase in the rate charged the small consumer, which is regulated by franchise.

Economy of Electric Pumping for Sluicing Shown.

One of the most interesting applications of motor-driven centrifugal pumps is for hydraulic sluicing, the accompanying illustrations being typical of installations made in the West. Fig. 1 shows a 2000-gallon-per-minute, motor-driven pump on the edge of a swamp which is to be partially filled in. The suction side of the pump is equipped with a 10-inch foot valve. There is a check valve on the discharge side to protect the pump from water hammer. The check valve has a one inch by-pass for priming the pump. Four hundred feet of 8-inch spiral riveted pipe carry the water up to the top of the hill to the shed shown in Fig. 2, where part of the water is raised in pressure by a 500-gallon-per-minute centrifugal pump for the cutting streams. The remainder of the water is utilized for washing the loosened earth and stone down the hill to the flume. Fig. 3 shows one of the cutting streams in use. The recoil of the nozzle is so great that it is necessary to fasten it to a heavily weighted tripod or connect it to something solid ahead of the nozzle. The high-pressure stream burrows in the bank and tears out the earth and stone which are carried down the hill and through the flume by the velocity of the water. Fig. 4 shows the flume discharging its mixture of water and solids on top of the newly made land. The larger pump required 60 horsepower and the smaller one 20 horsepower. The percentage of solids in the discharge from the flume averaged from five to ten per cent. This method of excavation and fill is a most economical one to use if the soil is fairly light, if the grade is good, and if there is an abundant supply of water.

Youngstown Company to Furnish Steam Service.

The heating service operated by the Youngstown Heating Company, a subsidiary company of the Mahoning County Light Company, furnishing steam to a number of large buildings in the business district of Youngstown, O., has been taken over by the Mahoning & Shenango Light & Power Company, which will operate it in connection with its North Avenue generating station. The heating company found that the rising cost of fuel and labor made it impossible to furnish the service at a profit, whereas the Mahoning & Shenango Company will be able to operate the steam service as an offshoot of the principal business of its generating station.

The Northern States Power Company is expected to save at least 2,500 carloads of coal during the remainder of 1917 under its contract for hydroelectric power from the Wisconsin-Minnesota Light & Power Company. An amendment to the existing contract gives the Northern States Power Company more energy than was originally contemplated, for the next five years. Approximately 40,000,000 kilowatt-hours additional power will be required during 1917 to supply demands of the company's business.

Fig. 3.—A Cutting Stream in Operation.

Fig. 4.—Discharge End of Flume.

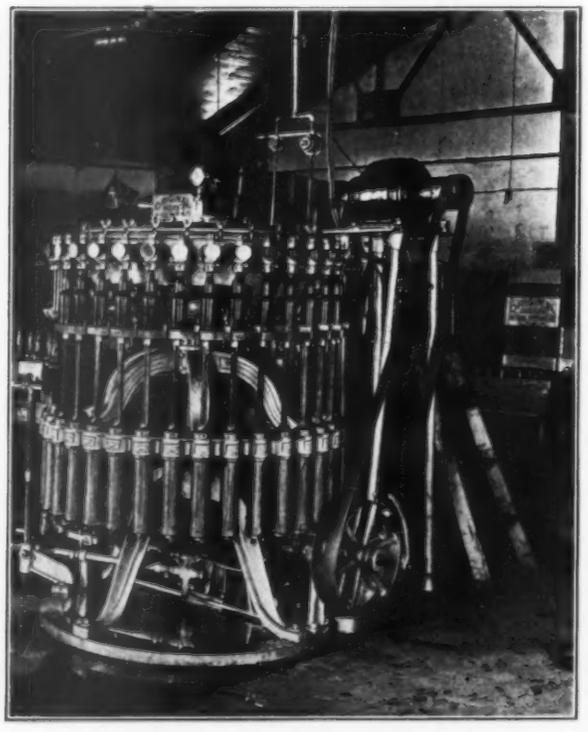
Electrical Construction Notes

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Electrical Installation in Brewery Results in Economy.

The establishment of the DuBois Brewing Company, at DuBois, Pa., is being equipped electrically by the contracting firm of Lee Goldstein, of DuBois, who has supplied us with the accompanying photograph, showing how the use of motor drive has resulted in decided economy in the operation of a large bottling machine. Originally this machine was run from a line shaft and had a capacity of filling 60 bottles per minute or 3600 per hour. The shaft drive was removed and a two-horsepower Crocker-Wheeler motor, running at 600 revolutions per minute, was installed to drive the machine. This drive gave higher and steadier speed to the machine so that it now fills 72 bottles per minute or 4320 bottles per hour. During the average run of a week this motor loses less than three minutes' time, and this happens only when the air pressure drops so that the machine has to be shut down until readjustment of the air regulator can be made.

The electrical generating equipment already installed for the company's brewery consists of a 75-kilowatt Westinghouse generator direct-driven by an Erie engine, a 35-kilowatt generator driven by a Keystone engine, and a 25-kilowatt generator driven by a DeLaval steam turbine. Each of these machines is a direct-current unit, and a pressure of 110 volts is used throughout the plant for lighting and motor service. All of the equipment, including numerous motors, has been installed by Mr. Goldstein's organization.

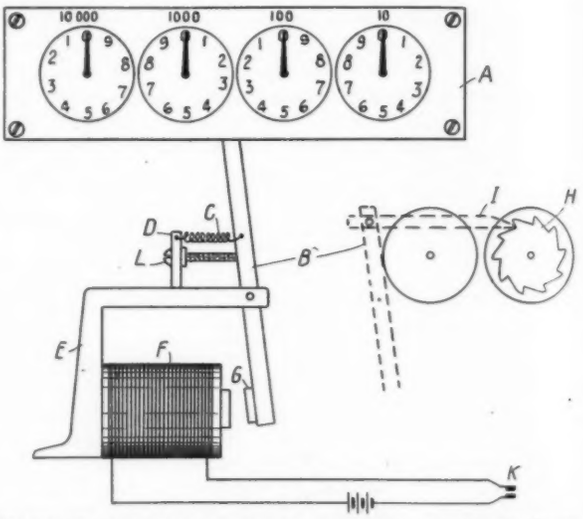


Economical Motor Drive for Beer-Bottling Machine.

Electrically Operated Revolution Counter.

By T. T. Tallman.

Finding it necessary to take an accurate count of disk revolutions made by direct-current watt-hour meter, I designed the device shown herewith, which I find to be quite accurate and also easy to make. Its uses are varied, such as counting turns while winding field or magnet coils, as a speed



Electrically Operated Revolution Counter Using Simple Parts.

indicator for motors, etc. All parts may be readily found in the shop. It consists of a four-dial gear train from a discarded watt-hour meter, an ordinary magnet coil such as is found in electric bells, and a few other parts which can easily be made, as seen from the sketch. The hand on the right-hand dial moves one space each time the magnet is energized, thereby actuating the other three dials at a ratio of 10 to 1. The gear ratio on all the dials is 10 to 1. The counter operates on the same principle as when used for a recording watt-hour meter, except that the right-hand dial hand moves one space each time instead of continuously. Make the ratchet wheel of 1/16 inch sheet brass with 10 teeth and solder it or make it tight on the same shaft with the pointer on the right-hand dial. The lever parts and the part engaging the ratchet should be made of brass rods or bars of such size as will be in proportion to the other mechanism.

To Clean Gummed-Up Brush Holders.—A good method for cleaning gummed-up brush holders is as follows: Dissolve a small amount of caustic soda in warm water, place the brush holder in the solution and leave it there for one-half hour. Any oil still remaining on the brush holder after this treatment may be taken off with a stiff brush. Next wipe dry with a clean cloth. The soda or lye is sharp but free from danger, nor are steel or brass parts attacked by it. If the coating is very thick and dry, it may be necessary to use a very hot soda solution. M. J. Moriarty.

Field Troubles Affecting the Commutation of Motors and Generators

A Discussion of Shunt and Series-Field Troubles that Frequeutly Account for Violent Sparking and Other Commutation Difficulties in Direct-Current Machines

By E. H. MARTINDALE

Chairman, Industrial and Domestic Power Committee, A. I. E. E.

This is the sixth of a series of 14 articles on the solution of commutator and brush troubles. The series began in the issue of March 24 and appears at intervals of two weeks. The earlier articles of the series were devoted to brush characteristics and a general discussion of commutation troubles. The value of commutator slotting was pointed out in the last installment. In the present and future articles other troubles and their remedies are discussed.

IN well designed and properly maintained noninterpole machines, the air gaps under all poles should be approximately the same and the magnetic saturation of the pole faces and distance between pole faces should be such that the machine can operate at any normal load without the necessity of shifting the brushes to prevent serious sparking when the load varies.

Field Distortion and Neutralization.

Fig. 1 illustrates the shifting of the magnetic field which always occurs to a greater or less extent in a noninterpole generator under load. For the sake of simplicity the brushes are shown as bearing directly on the armature surface instead of on commutator bars connected to the coils. The current passing through the armature coils in the sections *ab'* and *ba'* produce magnetic fields at *N'* and *S'* at right angles to the magnetism of the main poles *N* and *S*. This results in a shifting of the magnetic field, as shown in the illustration.

To keep the brushes in a neutral field they must be shifted forward from the mechanical neutral to the line *aa'*.

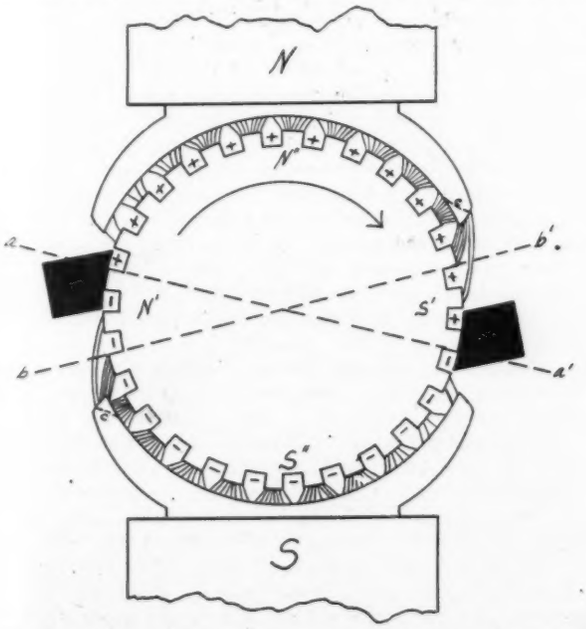


Fig. 1.—Diagram to Show Shifting of Magnetic Field in an Ordinary Direct-Current Generator.

The current through the sections *ab* and *a'b'* produce magnetic fields at *N''* and *S''* which oppose or tend to demagnetize the main poles. The greater the load on the generator, the greater is this demagnetizing action, which reduces the voltage of the generator. This reduction of field strength taken with the resistance of the armature and the reduction of the shunt-field current, due to the lower generated voltage, results in poor voltage regulation on large noninterpole shunt generators. They are therefore usually equipped with a compound field winding to counterbalance the other losses.

In a motor the field shifts in the opposite direction and the brushes should be shifted back of the mechanical neutral to keep them in the magnetic neutral. The same depolarizing action takes place but the weakened field tends to increase the speed of the motor and thereby offset the tendency toward speed reduction caused by increased load. Therefore the shunt noninterpole motor has good inherent speed regulation, although some may have poor commutating characteristics. Shifting of the magnetic field can be lessened and serious commutation troubles frequently overcome by beveling the pole tips, as shown by the dotted lines *c* in Fig. 1. The beveling should usually be done only on the forward tips of generator or the backward tips of motor poles.

In any well designed interpole machine the winding on the interpole is just sufficient to offset the magnetism pro-

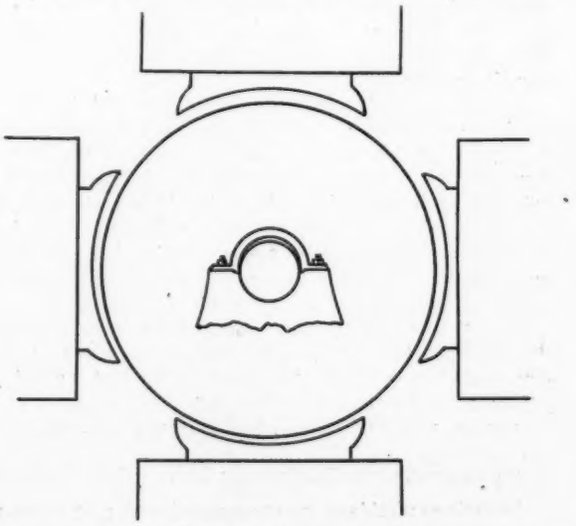


Fig. 2.—Section of Four-Pole Machine Showing Unequal Air Gaps Due to Wear on Bearings.

duced by the armature current and will therefore prevent any shifting of the magnetic field and give sparkless commutation at all loads. A poorly designed interpole winding is worse than none because the interpole field core offers a low-resistance magnetic path for the cross magnetizing produced by the armature current.

Troubles Due to Wear of Field Bearings.

In interpole, as well as in noninterpole, machines it is important that the air gaps be kept uniform. Fig. 2 shows an armature in which the wear of the bearings has permitted it to run closer to the lower pole face than to the upper. In a wave-wound machine this is not very serious as the voltage generated under the various poles is equalized in the winding. In a lap or parallel-wound machine, however, the portion of the armature under the small air gap will generate a higher voltage than the portion under the large air gap.

In the early stages of the wear, shown in Fig. 2, the lower half of the armature, if the machine is a generator, will begin to assume more than its share of the load. This increases until the difference in generated voltage equals the resistance drop of the armature under normal conditions, at which point the lower half of the armature will carry all of the load. Any further wear of the bearings will produce a local current between the upper and lower halves of the armature through the brush rigging. The result will be that the upper half will act as a motor driven by current generated in the lower half.

In a motor the smaller air gap produces a higher counter electromotive force and when this equals the line voltage, the upper half of the armature will carry all of the load. Additional wear will cause the lower half to operate as a generator, driving the upper half.

Wear of the bearings instead of being caused by the weight of the armature, may be caused by belt pull or by a combination of the two. In either case the trouble can be remedied by putting in new bearings. Air gaps can be checked mechanically with thin strips of metal or other material. A variation of 10 per cent in the air gaps may be sufficient to cause serious heating and an apparent inability of the machine to carry full load. Sometimes the poles themselves vary in length, in which case the faces of the long poles should be ground off or the short poles should be shinned to make equal air gaps.

Test for Voltage Equality.

In a lap-wound generator the voltage generated in different sections of the armature may be determined by disconnecting the busbars which join all brush studs of like polarity and operating the generator at no load. Each section of the machine will then operate independently and the voltage between studs will show the variation due to the unequal air gaps.

In a lap-wound motor the busbars should be disconnected from the brush studs and the speed determined with the brushes on two adjacent studs bearing on the commutator, all other brushes being removed. This test should be made for each pair of brush studs. If the air gaps are unequal enough to cause an unequal distribution of the load, the motor will operate slowest when the brushes adjacent to the shortest air gap are in contact, and fastest when the brushes adjacent to the long air gap are in contact.

In cast-iron yokes or pole pieces blow holes are sometimes so large that the magnetic flux through one or more poles is greatly reduced. The above is the best method for locating such defects after other tests have shown that all air gaps are equal and that all field coils are in proper condition.

Other Commutation Difficulties Due to Field Troubles.

Sometimes machines are encountered with pole pieces unequally spaced, due to cheap or careless construction. In such cases the brushes cannot be equally spaced to secure good commutation but should be set by measuring the voltage on the commutator between the toe and heel of a brush on each stud, or the pole spacing should be corrected.

The pole arcs are sometimes too great, not allowing sufficient space between adjacent pole pieces. This places the coils undergoing commutation in a strong field with resultant short-circuit currents, severe sparking and all the attendant evils.

It very rarely happens that a manufacturer sends out a machine with one field coil reversed but this may occasionally happen when a machine is overhauled. In a lap-wound motor or generator this condition will be evidenced by extreme sparking at the two adjacent brush studs and excessive heating of the armature after a few minutes' run, or the armature may be burned out. In a wave-wound motor there will be a reduction of torque and in a wave-wound generator a reduction of voltage. The polarity of each pole should be different from that of the adjacent poles. This can readily be tested by any iron placed across adjoining pole faces. One of the best methods is to use two nails, each a little shorter than the distance between poles. One nail should be placed on each pole with the ends touching. If the polarity is correct, the nails will stick together, while if the polarity of one pole is reversed, the nails will fall. If the machine has a compound field this test should be made with only the shunt winding excited and then repeated with only the series field excited.

There are two kinds of compound windings, *cumulative*, in which the shunt and series windings assist each other, and *differential* in which the windings oppose each other. The differential, used only on motors to obtain constant speed or increased speed with increased load, is rarely encountered. The cumulative is used on motors to get increased torque with increased load and a high starting torque. It is used on generators to keep the voltage constant, or get increased voltage with increased load to offset line drop and thereby keep a constant voltage at the load.

In a cumulative compound motor the series field may be incorrectly connected up to oppose the shunt field. The series field is then said to "buck" the shunt. This will usually be evidenced by increased speed with increased load, together with severe sparking and blackening of the commutator. To test this, the shunt field should be excited and the polarity of each pole determined by a compass. Care should be taken to bring the compass near the pole slowly and in a position to allow the needle to move freely, as it is very easy to reverse the magnetism in the ordinary commercial compasses on the market. The polarity of each field should be marked and the test repeated with only the series field excited, being sure that the current flows in the same direction as when the machine is in operation. The polarity of each field should correspond to that obtained when the shunt field was excited.

Shunt-field coils are usually connected in series and a short circuit may occur in one coil without showing any outward effects and can only be detected by measuring the voltage drop across each coil. Such a short-circuit will usually cause sparking at the two adjacent brush studs. It will generally be necessary to rewind the coil before the trouble can be corrected.

Damp field coils permitting a leakage may cause the same effect but can be corrected by simply drying out carefully.

A grounded field coil will reduce the current in all the field coils beyond the ground, and therefore, the defective field cannot always be located by the voltage drop across the coil. The field coils should be disconnected and each one tested for a ground with a magneto or telephone set.

If the field coils run too hot and are hotter than the pole faces, the heating can be reduced only by decreasing the field current. In a motor this will mean increased speed, in a generator it will mean lower voltage or will require a higher speed to maintain the same voltage.

If the field core is hotter than the coils, the trouble is due to eddy currents in the iron. An effort should be made to steady the load which will lessen the heating, and if this does not reduce it to a safe limit, the field cores, if laminated, should be taken apart and the laminations enameled. If the cores are solid, the heating may be overcome by the use of laminated cores.

Insurance Interests Bring About Electrical Development.

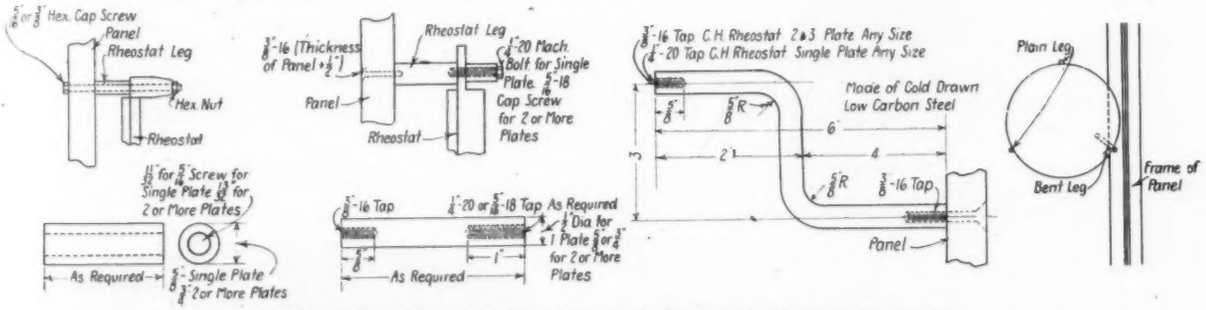
The Kentucky Insurance Board, which has jurisdiction of fire-insurance rates and regulations, has put into effect a new policy of dealing with complaints as to high rates. Whenever complaints are made to it by property owners in towns which have undertaken to improve their fire-fighting equipment, the Board now sends representatives who are experts in their lines and they go over the situation with the owners, suggesting improvements which should be made to reduce the fire hazard and reduce the rate. For instance, on complaint of citizens the board recently sent representatives to Providence, Ky. There it was found that owners of commercial property were being penalized because they were using dangerous gasoline-lighting systems, while in other cases the electric light wires had been put in without observation of the National Electrical Code.

The fire-insurance situation in Kentucky is being improved greatly and under the central-office plan the rating of risks is made carefully, with due penalties in the way of increased rates for defective wiring, gasoline-lighting systems, etc. Three property owners at Providence, for instance, threw out their gasoline systems when it was pointed out to them that they were the cause of the excessive rates, while a motion-picture theater owner and others undertook to have their electric wire systems overhauled.

Reliable Mounting of Rheostats.

By H. E. Weightman.

A good rheostat, no matter for what service, needs a rigid mounting. This is especially true of rear-of-board type



Details of Rigid Rheostat Mountings with Plain and Bent Rheostat Legs.

mountings. Mr. Moriarty, in an article on page 633 of the April 14 issue, advocates the use of the fragile, rough-dimensioned and (to my sense) clumsy appearing porcelain knob. Herewith are several rough sketches showing the proper way to mount a rheostat. The methods shown are simple, every-day standards of the large companies and are cheap. I would refuse to accept a job made as suggested by Mr. Moriarty.

Among the Contractors.

Six special receptacles for electric irons have been installed at the German Protestant Orphans' Home in Louisville, Ky., by Philip A. Wagner, electrical contractor, this being one of the first of the orphanages of the city to make these improvements. The irons will be for use in the laundry of the institution, where the older girls do the work for the establishment, which uses central-station energy. In view of the fact that they will be used by girls more or less irresponsible, they will be equipped with pilot lights to indicate when the current is on.

John W. Collom, 60 William Street, Newark. N. J., has filed notice of business organization to handle electrical supplies, etc. Matthew V. Hecke, 15 North Sixth Street, is also interested in the business.

The Electrical Motor & Repair Company, 264 Halsey Street, Newark, N. J., has been organized by Herman C. Heidrich, 57 Mead Street. John G. Bender, 719 South Fourteenth Street, is also interested in the company.

Victor A. Rohner, Newark, N. J., has acquired property at 400 Frelinghuysen Avenue, and will establish a motor and electrical repair plant.

James A. Atwood, Dayton, O., has been awarded the contract for the wiring for electric light and power in the Montgomery County (O.) Children's Home.

Walton and Doane have opened beautifully equipped and decorated show rooms at 109 Sixth Street, Lorain, O. The firm will conduct a general electrical supply and service business. A. B. Walton was formerly chief electrician at the local shipyards and his partner was foreman of the electrical shop there. Both men are expert electricians. The new show rooms are decorated in good taste. The walls are wainscoted and the most modern electric lighting fixtures in a wide variety are displayed. In addition to lighting fixtures, lamps and household appliances of every description, the firm will conduct a general contracting business.

The K. W. Electric Company, with offices and a repair shop at 47-49 Lawrence Street, Newark, N. J., has completed several thousand dollars' worth of business in the first year of its career, and reports considerable business in view. The success of the new company probably is due to the activity and business efficiency of A. H. Koellheffern, president of the company, and M. C. Wright, treasurer. Both have had unlimited experience in all branches of the electrical business. Within a short period after the company was in existence it installed in the city and vicinity more than 3,000 horsepower in electric motors which are used for various purposes. The entire electric power equipment, including generator, switchboards and motors, has just been installed in a large paper mill located in this vicinity, in accordance with the specifications of the K. W. Electric Company. When the company was organized in 1916 there were but two men employed. Now there are 48 and there is such a tremendous rush of business that it is more than likely that a great many more will be taken on within a short time. Probably the most thorough department in the company is the repair department, which is considered unrivaled in this vicinity. The company lost no time in realizing that with the enormous growth of demand for electric motors, repairing and rebuilding would be a vital part of its business.

New Electrical Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

New Inclosed Condulet Knife Swituh.

The Crouse-Hinds Company has placed on the market a new line of Condulets, called the MK series, which is of the highest order of "Safety First" construction. A Condulet of this series consists of a fusible knife switch, inclosed in a cast-iron body with hinged cover. A door in this cover furnishes access to the fuse compartment, but the design is such as to prevent this door from being opened when the blades are in the "on" position. Because of this latter fact, the person removing fuses is absolutely protected from receiving an electric shock.

The switch is operated by a handle outside the case, and provision is made for locking this handle, in either "on" or

Type MK Condulet Fused Knife Switch with Quick Make and Break.

"off" position, by the use of a padlock. While these Condulets are not regularly furnished with a quick-make and quick-break feature, they will be so furnished if the purchaser desires. Of course, it is understood that whenever operating conditions require frequent opening and closing of the switch under approximately full load, the life of the arcing parts can be materially lengthened by equipping the Condulet with the quick-make and quick-break attachment. The illustration of type MKC Condulet given herewith shows the switch as it appears with the quick-make and quick-break attachment.

The MK series of Condulets possess another desirable feature in that they are provided with separable hub plates of various types—blank, single-hub and two-hub plates. The latter two are made to take standard sizes of conduit from ½ to 3½ inches. This makes it possible to equip the Condulet for almost any arrangement of conduit installation and simplifies the work of installing.

Each type MK Condulet is made in numerous capacities, ranging from 30-ampere, two or three-pole, 125-volt, to 200-ampere, 500-volt, alternating-current three-pole switches, arranged for National Electrical Code fuses.

Besides giving full protection against injury to persons operating the switch, a Condulet of this series is also a "Safety First" fitting in regard to itself. That is, it is dust-proof, weatherproof and, because of its strong construction, both as regards the switch and the case, can stand the hardest and roughest usage. Full details regarding these Condulets are given in Condulet Bulletin No. 1000G, which will be furnished free to anybody applying for it to the Crouse-Hinds Company, Syracuse, N. Y.

Interborough Company to Install a 60,000-Kilowatt Three-Cylinder Compound Turbogenerator Set.

The new 60,000-kilowatt unit to be installed in the Seventy-fourth Street station of the Interborough Rapid Transit Company of New York City, where three 30,000-kilowatt cross-compound Westinghouse turbine generators have been in successful operation for over two years, will consist of a high-pressure and two low-pressure turbines, each coupled to a generator. Each of the three turbogenerators making up the unit is to have a governor so arranged that if for any reason the circuit should open on the high-pressure turbogenerator, steam will be shut off from that particular one and the two low-pressure turbogenerators will operate under governor control with high-pressure steam. Likewise, should anything happen to both the high-pressure and one of the low-pressure turbo units, or to the two low-pressure turbogenerators, the remaining one will operate and carry the load.

The turbines, which will operate at 220 pounds absolute steam pressure, 120 degrees superheat, 20-inch vacuum, and the generators, which will have a combined capacity of 60,000 kilowatts continuously or 70,000 kilowatts for two hours, are being furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Commercial Lighting Fixture.

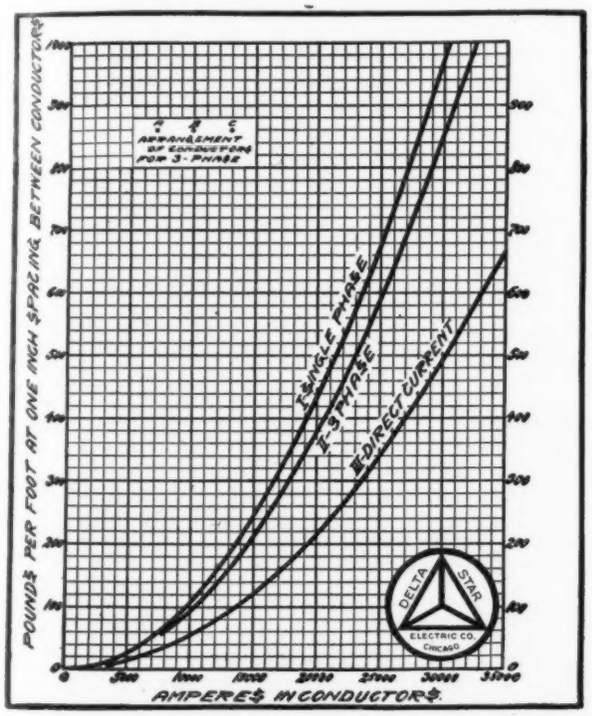
The use of semi-indirect lighting is becoming quite popular for the illumination of offices, stores and other commercial interiors, and a growing demand is being shown for equipments of this type. The Art Metal Manufacturing Com-

New Design of Amco Commercial Semi-Indirect Lighting Fixture.

pany, Sixty-first Street and Curtiss Avenue, Cleveland, O., has for some time been manufacturing a line of commercial lighting equipment known as the Amco commercial line. A new fixture of the semi-indirect type has been added to this line. As shown in the accompanying illustration, it is designed for efficiency as well as attractive appearance. The company is also the manufacturer of the well-known line of Amco electric fixtures and fixture parts. The fixture illustrated is one of the new designs which appears in a new complete catalog which the company has just issued covering these two lines of fixtures.

Lock for Preventing Current Surges from Opening Disconnecting Switches.

In stations of large generating capacity having circuits subject to abnormal current surges, it has been found that disconnecting switch blades will be forced partially open, due to the heavy magnetic field generated around the blade and acting against the field of other conductors, cables, etc. The opening of such a switch under load conditions results in destructive arcing between the blade and contacts, invariably causing serious operating troubles and at the least interrupting the continuity of service.



Curves Showing Electromagnetic Stresses Between Parallel Conductors.

That the forces developed under heavy short-circuit conditions very often reach high values is demonstrated by the accompanying curves. These curves show the maximum force exerted per foot between two parallel conductors at the theoretical spacing of one inch between the center lines of conductors.

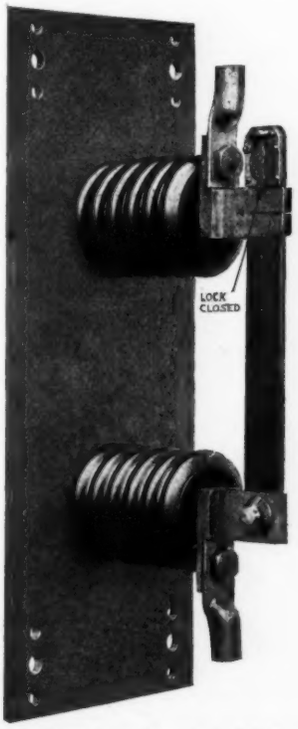
Curve No. I shows the maximum force exerted between two parallel single-phase conductors. The instantaneous force varies with the instantaneous current value, but is always in the same direction.

Curve No. II shows the maximum force exerted on conductor *B* in a three-phase system having all conductors arranged side by side as shown in the diagram. This force varies from the maximum value to zero in one direction, and then from zero to the maximum force in the opposite direction. The effect, therefore, is more severe than a corresponding force exerted between two single-phase conductors. Force exerted on conductors *A* and *C* is slightly less than that exerted on the middle conductor *B*.

Curve No. III shows the maximum force exerted between two parallel conductors carrying direct current. This force is constant and may repel or attract, depending upon the direction of current flow in the two conductors.

These curves are correct for a circular bus at any commercial spacing. For rectangular buses, where the distance between bars is small compared with the cross-section of the bars, the actual forces exerted will be of lower value than shown.

To meet conditions incident to heavy-capacity stations where short-circuits or heavy current rushes would develop sufficient electromagnetic effect to force switch blades open, absolute locks of the type shown have been successfully used. The lock consists of a pivoted and spring-controlled latch, fastened to the upper end of the switch blade, and arranged to engage a slot in one of the contact clips. This design insures a positive effective lock, with minimum working parts, and a device easily understood by station operators.



Disconnecting Switch with Safety Lock.

When it is desired to open the disconnect, the ordinary type of hook stick is used and automatically disengages the lock. When closing, the lock automatically engages as the switch stick is removed. This simple lock has, therefore, solved a troublesome problem in a very satisfactory manner. It is being furnished on the disconnecting switches marketed by the Delta-Star Electric Company, Chicago, Ill.

Insulating Compounds of the Varnish, Shellac and Paint Type.

Insulating compounds is a general term applied to insulating varnishes, shellacs, paints, cements, and glues made expressly for use in connection with various pieces of electrical apparatus. The selection of the proper insulating compound presents one of the most complex phases of insulation application, and the user of such material should study carefully the characteristics of the various kinds before selecting any particular one for a given service.

The materials here described are made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and are used extensively by that company in the manufacture of electrical apparaatus. Research work has demonstrated their desirability for the classes of service for which they have been developed.

Varnishes.—There are two baking and two air-drying varnishes. The baking varnishes are: amber insulator, and plastic insulator. The air-drying varnishes are: air-drying insulator, and finishing varnish.

Amber insulator is a clear amber-colored baking varnish having a very high dielectric strength and is very durable under operating conditions of heat and vibration. It is oilproof, acid and moisture-resisting, has excellent penetration and furnishes a hard surface with considerable flexibility which makes it very firm in resisting mechanical injury. It has a wide range of baking temperatures, but bakes best at 115 degrees centigrade in eight hours. This varnish is used for general insulating purposes, such as for armature, field, and transformer coils, finishing coats on armatures, and for a coating on wood strain insulators. It is applied by dipping and brushing, benzine or varnish maker's naphtha being used for thinning.

Plastic insulator is a black baking varnish, plastic and flexible under operating conditions of heat and vibration. It is acid, alkali-fume, moisture, and oil-resisting. It has high dielectric strength and excellent penetration. It bakes best at 115 degrees centigrade and is especially adapted for coils and similar applications where the conditions of heat and vibration are severe, such as for railway and mill motor service. Best results can be obtained by making two or more applications of the varnish, dipping or brushing being the best methods of applying. Benzine or varnish maker's naphtha can be used as a thinner.

Air-drying insulator is a glossy, black, quick-drying varnish which may also be baked. It air dries in about one hour and bakes in 20 minutes at a temperature of approximately 90 degrees centigrade. It is suitable for use on connections of completed apparatus where baking facilities are not available for keeping out dust or moisture. It is also used as a finishing coat on magnet coils.

Finishing varnish is a glossy air-drying, oilproof, insulating varnish which dries quickly. It is used for general finishing work on electrical apparatus, such as armatures, field coils, wooden parts, etc., and is applied by dipping, brushing, or spraying. Thin shellac or alcohol may be used for thinning.

Shellacs.—There are three shellacs. One is an orange-colored, heavy-bodied, quickly-drying shellac used for general insulating purposes, especially for filling crevices and smoothing winding work.

The second one is a clear, transparent, quick-drying shellac which gives a flexible coating with hard surface. It is oil and moisture-resisting and dries in about 15 minutes. Its penetration and high dielectric strength make it particularly desirable for use on marble switchboards, fine woodwork, or similar applications where a colorless transparent varnish is required.

The third one is a very thin shellac used chiefly as a thinner for heavier solutions, in place of alcohol.

Insulating Paints.—There are three insulating paints—protective paint, flat black enamel, and switchboard lacquer.

Protective paint is air-drying and of a medium glossy black. It is flexible under all conditions, and is acid-fume, alkali-fume, and moisture resisting. It has no offensive odor and dries in three hours. It is intended for use on surfaces exposed to the weather and provides excellent protection against corrosion. Benzine is used for thinning this paint.

Flat black enamel is a quick-drying, finishing paint containing a black pigment, but free from lampblack, and dries without luster. It becomes dust-dry in 15 minutes and dry-hard in two hours. Its nonconducting qualities make it suitable for use on insulating parts as well as on castings and other metallic surfaces. For best results it should be used over a filler. It is applied by brushing and may be thinned with turpentine.

Switchboard lacquer is used on marble and slate. It is a dead black and produces a velvety finish on rough or smooth surfaces. It air dries in about 15 minutes but gives the best finish if baked for about 2.5 hours at 35 degrees centigrade.

Insulating Cements.—There are four grades of insulating cement: commutator cement, armature cement, oilproof cement, and arc-resisting cement.

Commutator cement is used for filling grooves in undercut commutators, repairing pitted commutators, etc. It contains no acids and sets quickly. This cement is unaffected by expansion or contraction and will not burn or lose its insulating qualities when heated. When used to fill the small spaces between commutator bars it will not crumble. It consists of a powder and a liquid packed unmixed in separate containers.

Armature cement is used principally in railway motor armatures for filling in purposes on the front and rear ends, and around the ends and leads of the coils to give rigidity and protection from injury due to vibration.

Oilproof cement is a hard, oilproof compound for filling spaces in and around transformer bushings, and for similar applications requiring an oilproof cement. It flows readily at 160 degrees centigrade, melts at 125 degrees, and softens at 110 degrees centigrade.

Arc-resisting cement is a superior material for repairing arc deflectors and arc chutes, rheostats, asbestos lumber, cement, stone, porcelain, and other heat-resisting substances, as it is a better heat resister than any of them. It will withstand temperatures up to 800 or 900 degrees centigrade and is applied cold like putty. It air-dries in approximately ten hours and bakes dry in about three hours.

Insulating Glue.—Insulating glue is a liquid which is usually applied cold, but can be baked. Being chemically neutral and very adhesive it is extremely useful for fastening tape ends, for closing cells, and for gluing insulating materials in general. It may be thinned with warm water.

New Type of Flood-Lighting Projector for Use with Large-Size, Gas-Filled Lamps.

The great importance attached to flood lighting, especially at this time, is bringing about the development of new units to meet increasing demands for this purpose. A new projector unit with very interesting features has recently been added by the National X-Ray Reflector Company, 235 West

New Mogul Projector for Use with Large Mazda Lamps.

Jackson Boulevard, Chicago. This company has for several years been manufacturing a projector that can be used with 200 and 250-watt lamps. Realizing that many flood-light installations can be carried out more economically by using larger lamps, the company has now developed the projector

illustrated herewith, which is known as Mogul projector, No. 90.

This outfit has an X-Ray reflector of the silver-mirror type and special parabolic form. The projector can be used with any standard Mazda type C lamps with Mogul base ranging in size from 300 to 1,000 watts and will also accommodate the 1500-watt in the type P. S. bulb. The lamp burns in its natural pendent position, which insures long life. The fact that the device can be accommodated by vertical adjustment of the socket to lamps of such wide range in size makes it a very flexible projecting unit. Provision is made for accurately focusing axially any of these lamps so as to obtain a powerful and concentrated beam of light.

The projector has a hinged top hood which when opened makes readily accessible the focusing and adjusting mechanism of the lamp itself, the reflector and the inside of the glass front. Thus the lamps may be readily cleaned or replaced and the reflector and front glass easily cleaned. The front glass itself does not have to be removed.

The outfit is made of heavy sheet steel and castings finished in black. It is well ventilated and entirely waterproof. An adjustable stand is provided by means of which the projector can be easily turned and adjusted, both horizontally and vertically, so that the beam of light can be projected to any desired location within the working range of this unit, which is especially suited to all places where a large volume of light is required on a limited area or where the throw of the beam is over 200 feet.

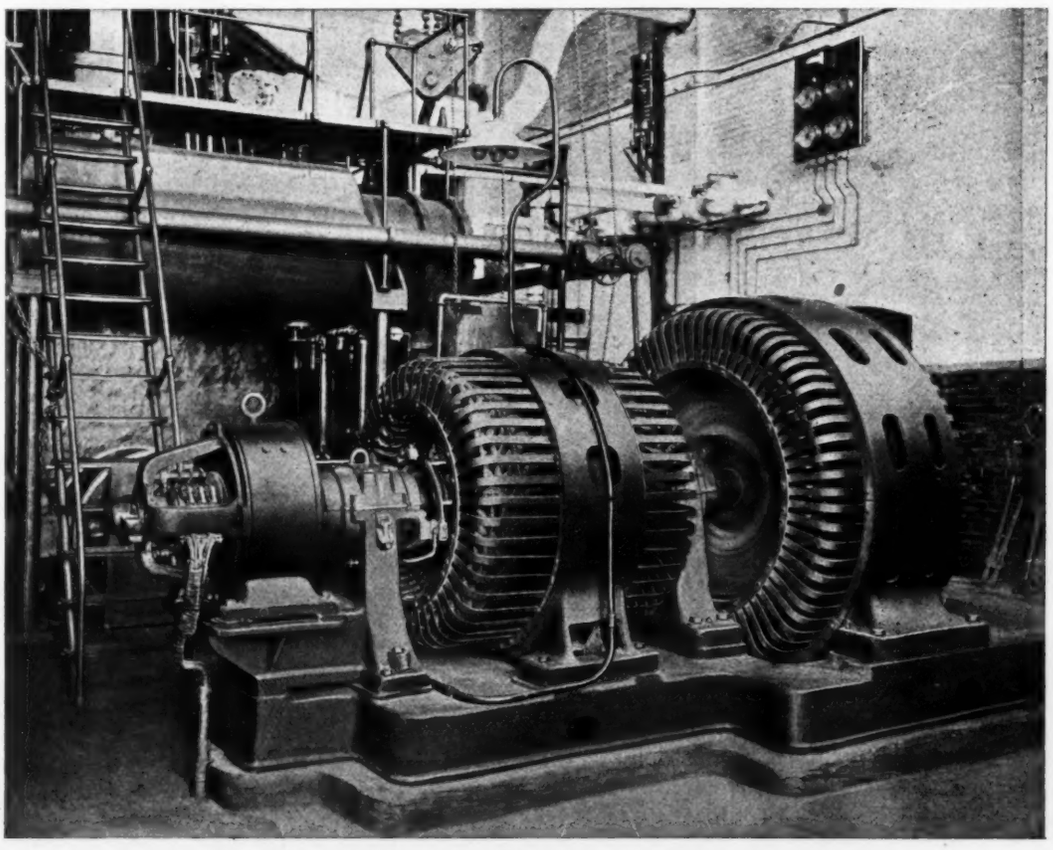
Voltage Regulation of the Westchester System.

The 13,200-volt system of the Westchester Lighting Company, which furnishes light and power to numerous towns in Westchester County, N. Y., is supplied from the 201st Street generating station of the United Electric Light & Power Company, New York City, at three points. In addition, power is generated at certain times of the year in stations of the Westchester company at New Rochelle, Ossining, and Peekskill.

The system of the Westchester company is divided into approximately two sections, with about 6,000 kilovolt-amperes in the lower and 4,000 kilovolt-amperes in the upper section. The lower section extends from New Rochells to Portchester, while the upper section comprises that part of the system from New Rochelle to Peekskill. In order to compensate for the comparatively low power-factor of the commercial load at Portchester, it was decided to install there a condenser of sufficient size to raise the power-factor of the lower section to approximately 90 per cent on the peak load. A 2,500-kilovolt-ampere, 2,300-volt, Westinghouse synchronous condenser has therefore been installed. The day-load power-factor at Portchester is about 65 per cent with a load of 1,500 kilowatts, and the condenser installed is operated at such a load as to raise the power-factor to approximately 95 per cent, which in turn raises the power-factor on the lower section about 15 per cent. At Ossining, in the upper section, the power-factor of a 1,600-kilowatt load has been raised from 70 to 95 per cent by the installation of a 1,500-kilovolt-ampere, 2,300-volt, Westinghouse synchronous condenser.

Although the two condensers connected to the system are hand-controlled, they play an important part in steadying out the voltage. The induction regulators installed at the various substations are of the automatic type. The combination of synchronous condensers and voltage regulators gives excellent voltage control, stability, and regulation in all the stations, in addition to merely increasing the power-factor of the supplied energy.

The operating results of the installation have proven highly satisfactory and have given the stability and regulation anticipated from previous study of the conditions obtaining.



Large Synchronous Condenser in Substation of Westchester System.

Activities in the Trade

Franklin Electric Manufacturing Company, Hartford, Conn., has issued a mailing folder which emphasizes the contentment that is secured by use of Franklin Mazda lamps.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announce that work on the first of its new six-story factory additions is progressing rapidly. The new building is of fireproof reinforced concrete construction. The four lower floors of this first unit will be turned over to manufacturing, stock rooms and testing rooms, while the two upper floors will be devoted to office purposes.

The Electric Storage Battery Company, Philadelphia, Pa., is sending out a mailing folder which gives views of its new eight-story factory building which is being built as an addition to its plant in Philadelphia.

The Art Metal Manufacturing Company, Cleveland, O., has recently increased its capital from $15,000 to $125,000. The company has recently compiled a new general catalog, and will be glad to receive requests for it from the trade.

National X-Ray Reflector Company, 235 West Jackson boulevard, Chicago, Ill., has issued a booklet entitled "X-Ray Standard Window Reflectors," a feature of which is the showing of shopping districts in seven large cities of this country in which many of the show windows are illuminated with X-Ray reflectors.

Landers, Frary & Clark, New Britain, Conn., have issued a folder announcement to the trade, emphasizing the seasonable demand for their line of Universal electrical devices for the home and suggesting ways for dealers to retail these comfort-giving appliances during the summer season.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued booklet "E," a 32-page publication describing C-H control equipment for electric elevators. It covers various classes of control such as hand-rope control, car-switch control and push-button control for all classes of freight and passenger elevators. The booklet is well illustrated and also contains information on elevator control accessories such as door safety switches, phase-failure and phase-reversal relays, limit switches, slack-cable switches, brakes, etc.

National Carbon Company, Incorporated, Cleveland, O., has issued Brush Bulletin No. 1, entitled "Commutator Slotting." This bulletin contains much valuable information on this method of minimizing the troubles from commutation and contains much of the information that was published in an article on this subject in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of May 19, 1917, written by E. H. Martindale. Suitable carbon brushes for use with undercut commutators are recommended.

The Sterling Bronze Company, New York, N. Y., will furnish all of the lighting fixtures for the Hotel Commonwealth in New York City, both exterior and interior. The company is to furnish floor and table lamps, as well as lamps in the bedrooms. The fixtures are to represent the very latest ideas in this sort of equipment. The Commonwealth, occupying an entire block front in the Times Square section of the metropolis, will be the greatest hotel in the world. It is to rise 28 stories, to contain 2500 rooms and will cost, with its equipment, $15,000,000. There will be over 100,000 shareholders in the corporation. It is a big co-operative enterprise, in which each shareholder will benefit from the profits and the privileges of the great hostelry.

Monitor Controller Company, Baltimore, Md., originator of the "Just-Press-a-Button" system of automatic electric control for all purposes, announces that E. Wesley Vaughan has joined the sales organization of its New York office under Joseph Frese, manager. Mr. Vaughan has had practical experience in this field and in the electrical contracting business.

The Adapti Company, Cleveland, O., has issued catalog No. 106, containing a complete listing and illustrations of the large line of Adaptiboxes. Fittings appropriate for use with these boxes are also shown and described. Complete indexes of the Adaptiboxes and fittings therefor, also of receptacles, etc., of other manufacturers that can be used therewith, are also given. Copies of the new catalog, which is just off the press, are obtainable on application to the company.

Harvey Hubbell, Incorporated, Bridgeport, Conn., has issued bulletin No. 15-24, dealing with Hubbell angle reflectors. These are described and illustrated, together with the types of holders suitable for use with them. These reflectors range in size so as to be capable of use with lamps from 25 to 1000 watts. The company has also issued bulletin No. 15-25, on Hubbell steel reflectors for mogul-base lamps of 300 to 1000-watt sizes. They are described and illustrated similarly to the angle reflectors referred to.

Central Electric Company, 320-326 South Fifth Avenue, Chicago, Ill., has issued a well-illustrated folder on flood-lighting projectors. These are of G-E type and made up in five different forms. The folder shows each one of these and describes it briefly, and also shows some very excellent examples of flood lighting by the use of these projectors. Among these installations is shown the Statue of Liberty in New York Harbor, the Soldiers' and Sailors' Monument in New York City, Sheridan's Monument at Albany, N. Y., the Courthouse at Duluth, Minn. The company has a good stock of these projectors on hand to meet the emergency demand that has arisen for them for protective lighting.

The General Electric Company, Schenectady, N. Y., has set aside $5,000,000 for the purchase of United States "Liberty Loan" bonds. In addition to this investment, as a means of assisting the Liberty Loan, the company will purchase Liberty Loan bonds for its 79,000 employees on subscription, in all denominations, to any amount, and give the subscribers extended time in which to pay for them. The company will pay for its employees' subscription bonds as required by the Government and will permit the subscribers to pay for them on the instalment plan, as follows: $50 bond, $1 per week; $100 bond, $2 per week; $500 bond, $10 per week; $1000 bond, $20 per week. Another optional plan is by monthly payments of 10 per cent of the subscription each month. Payments are to be deducted from payrolls, the first payment to be made on the payday following allotments. The bond subscribed for by employees will be delivered to them after employees have made their final payments with adjustment of interest. The General Electric Company recommends to its employees the purchase of Liberty Loan bonds as a patriotic duty, and on June 6 a canvass will be made in all departments and offices to receive subscriptions. A large number of employees have already expressed a willingness to subscribe for these bonds and under the company's instalment-payment plan it is believed that every employee can purchase, without financial inconvenience, one or more of the bonds.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

ATLANTIC CITY, N. J.—City Council is planning the installation of flood lights on the Boardwalk to permit night bathing. Director of Public Safety Sooy is in charge.

FREEHOLD, N. J.—The Board of Public Utility Commissioners has granted permission to the Jersey Central Traction Company and the Central Jersey Traction Company to consolidate under the latter name. Authority has also been given to the Jersey Central Traction to sell its power station, transmission lines and substations to the Monmouth Lighting Company, and stocks, bonds, etc., to the Middlesex & Monmouth Electric Light, Heat & Power Company, thus separating as far as possible the new traction company from the electric lighting business. In a second report the board grants permission to the two lighting companies noted to merge and consolidate. The Monmouth company now serves Freehold, Farmingdale and vicinity, while the Middlesex & Monmouth company furnishes service through the northern section of Monmouth County from South Amboy to Freehold. The lighting company is to pay a consideration of $701,200 for the electric generating properties of the traction company.

HOBOKEN, N. J.—The Board of Council, West Hoboken, has approved an appropriation of $21,500 for street lighting in its annual budget.

JERSEY CITY, N. J.—The Havana Electric Railway, Light & Power Company of Havana, Cuba, a New Jersey incorporation, has filed notice of increase in its capital from $30,000,000 to $36,000,000 for expansion.

LAMBERTVILLE, N. J.—The Board of Public Utility Commissioners has granted the Lambertville Public Service Company permission to execute a mortgage for $1,000,000, with part of the proceeds to be used for improvements and extensions in its plant and system. This property is operated by the National Utilities Company.

NEWARK, N. J.—The Board of Works has closed negotiations with the North Jersey District Water Supply Commission for the development of property for the extension of the Wanaque waterworks. The proposed work includes the construction of dams and steel pipe lines with total cost estimated at $8,000,000. Investigations will be made for the establishment of a hydroelectric power station. Morris R. Sherrerd is chief engineer.

NEWARK, N. J.—The Public Service Electric Company, Terminal Building, is planning for the erection of an addition to its Point-no-Point generating station to cost about $365,000.

NEWARK, N. J.—The electric installation to be made by the Passaic Valley Sewerage Commissioners, Essex Building, at the Newark Bay Pumping Station, bids for which will be received 9:30 a. m., June 19, will include the following: Three direct-connected 60-kilovolt-ampere (48-kilowatt with 80 per cent power-factor) generating sets, two-phase, 60-cycle, 220-volt; steam units to be vertical compound, automatic lubrication, to operate at 150 pounds gauge pressure. Also direct-connected exciter, with switchboard, field rheostat, and auto-transformers, for 220-110-volt lighting service. Joseph H. Quigg, clerk.

NEWARK, N. J.—The Board of Freeholders has granted the Public Service Electric Company permission to make tests at the electric generating plants at the Overbrook and Soho hospitals. The company holds that it can furnish electric energy to these institutions at a lower cost than the present isolated plants.

NEWARK, N. J.—The Board of Freeholders has awarded contracts for extensions in the power plant at the penitentiary, Caldwell, as follows: Engine, generator and switchboard to the Watson-Flagg Engineering Company, 27 Thames Street, New York, at $9,500; boilers and boiler equipment to the Salmon Heating & Contracting Company, 259 New York Avenue, Newark, at $16,789.

NEWARK, N. J.—The Board of Education (R. D. Argue, secretary) will receive bids on June 11 for electrical work, heating and ventilating, pipe covering and other work for different city schools.

NEWARK, N. J.—The Board of Freeholders will receive bids up to 4 p. m., June 6, for coal and ash-handling equipment at the power house of the Essex County Hospital, Overbrook. Runyon & Carey, 845 Broad Street, are consulting engineers.

SALEM, N. J.—The City Council is planning for the installation of new engine and pumping machinery at the municipal waterworks for auxiliary service. Mayor Grier is interested in the work.

TRENTON, N. J.—The Empire Tire & Rubber Corporation will build a one-story power house addition to its plant in North Clinton Avenue to cost about $10,000.

WHARTON, N. J.—The Borough Council has made an appropriation of $2,300 for street lighting.

WILMINGTON, DEL.—The County Commmissioners are considering the application for a franchise for the construction and operation of an interurban line from Wilmington to a point near Dover, with electric system for operation. A company is being organized for immediate construction and operation of the proposed road. De Armond Lindes, of Lindes & Company, Philadelphia, bankers; William F. Applegarth, Cambridge, Md., and Frederick Brady, Middletown, are interested in the project.

ALLENTOWN, PA.—The Lehigh Valley Realty Company is being organized as a holding company for the different subsidiary companies of the Lehigh Valley Transit Company. The same officials will operate the company, consisting of H. R. Fehr, president; Charles N. Wagner and C. M. Walter.

GIRARDVILLE, PA.—The Schuylkill Electric Company has made application to the Public Service Commission for approval of a 10-year contract to furnish commercial and municipal service. The company is planning for the installation of a local system. The Eastern Pennsylvania Light, Heat & Power Company, which now furnishes local service, has filed a protest against approval of the application, holding that the business in the borough does not warrant the service of two companies.

HARRISBURG, PA.—The Department of Public Safety, Bureau of Street Lighting, is receiving bids June 4 for lighting all streets and highways, as well as city municipal buildings, pumping station and filter plant. The service is to be furnished with 350-kilowatt magnetite arc lamps, commercially classed as 2,000-candlepower, or 60- to 100-candlepower incandescent lamps. S. F. Dunkle is superintendent.

HUNTINGTON, PA.—The Public Service Commission has ordered the Raystown Waterpower Company and the Penn Central Light & Power Company to establish a rate of nine cents per kilowatt-hour for service at Huntingdon and vicinity, with discount of from 10 to 20 per cent, according to amount used. Heretofore the companies in contesting for business in the same territory have been charging six cents and three cents per kilowatt-hour for service from the Raystown and Penn Central companies respectively.

LANCASTER, PA.—The Conestoga Traction Company is planning for extensions and improvements in its plant and system.

LANSFORD, PA.—The Lehigh Coal & Navigation Company is installing electric equipment at its Cranberry properties for mining operations. The work, with electric system for service, is estimated to cost $350,000.

PHILADELPHIA, PA.—The Bell Telephone Company is having plans prepared for an addition to its exchange building at Lancaster Avenue and Media Street. The company has awarded a contract to F. L. Hoover & Sons, 1023 Cherry Street, for improvements and extensions in its building on Ludlow Street, to cost $25,000.

PHILADELPHIA, PA.—William Linker & Company, Heed Building, have submitted a low bid to the Department of Charities for the construction of a new power plant at the Byberry Hospital at a cost of $76,900.

PHILADELPHIA, PA.—The Bureau of Yards and Docks, Washington, D. C., is taking bids for the erection of a new power plant at Philadelphia, about 100 by 270 feet. A similar plant will also be erected by the Bureau at Norfolk, Va.

ST. HELENA, MD.—The Dundalk Company, recently organized with a capital of $5,000,000 to establish an industrial city near Sparrows Point, primarily for employees of the Bethlehem Steel Company, is planning for the installation of an electric-lighting system for street and house service through the property. This improvement with other development work is estimated to cost $150,000. Edward H. Bouton, president of the Roland Park Company, Munsey Building, Baltimore, is head of the company. Edward L. Palmer, Dundalk, is architect.

WASHINGTON, D. C.—The Washington Steel & Ordnance Company, Giesboro Point, Md., will build a three-story brick and concrete power house at its works to cost about $60,000.

BRISTOL, VA.—The Kingsport Utilities Company has been incorporated with a $1,000,000 capital, to establish a light and power plant. Sherwood E. Hall, of White Plains, president.

NEWPORT NEWS, VA.—The Empire Steel Company, now being organized with a capital of $4,000,000, has made application to the Chamber of Commerce for a selection of a site for a large steel works. In connection with the proposed plant it is planned to build a power house for operation at an estimated cost of $60,000. Ernest B. Moore, Petersburg, Va., is interested in the company.

GAINESVILLE, GA.—The Southern Bell Telephone & Telegraph Company will erect an exchange building here at a cost of $13,000 and will expend $40,000 in improvements to its system.

NORTH CENTRAL STATES.

COLUMBUS, O.—The State Utilities Commission has authorized the Cleveland Electric Illuminating Company to issue $2,000,000 in first-mortgage bonds for improvements.

LORAIN, O.—Actual construction work on the new central station to be built by the Lorain County Electric Company has been commenced. Much of the equipment and material for the new plant is already on the site.

MARION, O.—The Columbus, Delaware & Marion Railway Company is planning to make additions to its local power plant, doubling its capacity.

ST. MARYS, O.—The town has awarded a contract for the construction of a municipal electric light plant and waterworks, to cost in the neighborhood of $47,000. Fred H. Froelish and John R. Emery, engineers, of Toledo, O., have charge of the work.

YOUNGSTOWN, O.—The new plate

mills of the Brier Hill Steel Company, which are to be constructed at once, will be operated entirely by electricity, a contract having been entered into by the company with the Mahoning & Shenango Railway & Light Company for 10,000 horsepower daily. The company will also install several large motor-generator sets of about 1,500 horsepower each for the generation of all direct current required.

EAST MOLINE, ILL.—Dr. G. F. Johnson, mayor, submitted to the East Moline City Council a suggestion that East Moline install a steam plant at its pumping station, and in that connection establish its own plant for street lighting.

GILLESPIE, ILL.—The Southern Illinois Light & Power Company will erect a new building and purchase new machinery for its electric plant here. J. J. Frey, Hillsboro, Ill., is manager of the company.

MOLINE, ILL.—To improve service in the Tri-cities the United Railway & Light Company will expend $400,000 in this community before November 1. Additional improvements are planned for next year which will be for the benefit of towns on the Illinois side of the river. The proposed improvements for this year call for the expenditure of $250,000 in Moline and Rock Island and $150,000 in Davenport, and include the following items: Installation of a 20,000-kilowatt turbine in the Moline power plant; building of towers on the Rock Island bridge to support wires to carry increased voltage to Davenport; installation of equipment in Davenport to receive and regulate the voltage required. Address General Manager J. F. Porter, 356 Fourth Avenue Davenport, Iowa.

NEW BERLIN, ILL.—A representative of the Kincaid electric plant has been making an effort to interest the local Board of Trustees in the installation of a new electric light and power system.

GOODRICH, MICH. — Ashton Jerome and Seth Jerome, of Flint, have purchased the Goodrich flouring mills and plan to remodel the mills and build a new concrete dam. They also intend to install an electric lighting plant and supply electricity for the town.

APPLETON, WIS.—The City Council is considering plans for improvements to the local street-lighting system.

MENASHA, WIS.—At a meeting of the City Council the Board of Public Works was instructed to confer with the Menasha Council for the final arrangements for ornamental lighting on Nicolet Avenue.

SEYMOUR, WIS.—The Seymour Electric Company has been incorporated with a capital of $10,000. W. E. Daniels is manager of the company.

TOMAH, WIS.—The city is planning the installation of additional street-lighting units.

WONEWOC, WIS.—Bids are being asked by A. B. Gale, of the Fower Engineering Company, 510 Corn Exchange, Minneapolis, Minn., for power house, transmission equipment for hydroelectric power plant and for auxiliary plant with internal-combustion engine.

JASPER, MINN.—A franchise for furnishing of electric service for street lighting and other purposes has been granted to Edmond Shella, of Letcher, S. D.

CORYDON, IOWA.—The Iowa Southern Utilities Company of Mt. Ayr is conducting negotiations for the purchase of the Municipal Electric Lighting Company.

MASON CITY, IOWA.—The Zahm Electrical Construction Company has been capitalized at $25,000 to engage in the business of buying, selling and manufacturing and repairing electrical goods. Address G. H. Zahm, manager.

NEW VIENNA IOWA.—The Eastern Iowa Electric Company, of Dversville, will construct an electric distribution system in New Vienna.

RUTHVEN, IOWA.—The Northern Gas & Power Company has applied for a franchise to furnish electric service in Ruthven.

SHELDON, IOWA.—The Sheldon Gas & Electric Company has purchased the Henry Runger cement plant and will erect a generating station there at once.

CLINTON, MO.—The Clinton light and water plant has been sold to Morrison & McCall, of St. Louis, Mo., who took charge May 1. They are planning on making a number of improvements.

FREDERICKTOWN, MO.—The Missouri Public Utilities Company is negotiating for the purchase of the municipal electric lighting plant.

HORNERSVILLE, MO.—The Arkansas Light & Power Company has been awarded a franchise to furnish electric service to the city.

KANSAS CITY, MO.—Mayor Edwards has authorized the announcement that a bond issue of at least $750,000 for a municipal light plant will be submitted to a vote at an election in November.

KANSAS CITY, MO.—Work has been started on the first group of buildings to form the plant of the Triangle Miding Company. The initial investment will be about $125,000. The Wimmer Construction Company, St. Louis, Mo., has the contract.

LADDONIA, MO.—The election here recently to vote on the proposal to levy a tax of 25 cents on each $100 valuation for a town lighting system, carried.

LA PLATA, MO.—A franchise has been granted to the La Plata Light & Ice Company to supply electric service for the city.

SMITHVILLE, MO.—Gordon & Morton are making preparations for the rebuilding of the Smithville electric lighting plant, recently destroyed by fire.

ST. JOSEPH, MO.—A proposition to vote municipal bonds to the amount of $165,000 for street-lighting extensions will be submitted at an election to be held June 26.

HADDAM, KANS.—The Concordia Light & Power Company is planning to extend its transmission lines to Cuba, Aganda, Haddam and Washington.

HAMILTON, KANS.—A meeting was held recently to discuss the proposition of voting $6,000 for bonds for an electric lighting plant.

HAYS, KANS.—Plans are being made by E. T. Archer & Company, Kansas City, Mo., for municipal waterworks and electrical improvements to cost $25,000.

KANOPOLIS, KANS.—Plans are being made for a special election to vote bonds for extensions to the electric lighting and waterworks systems.

LONG ISLAND, KANS.—The city has voted $8,000 bonds to build a transmission line connecting to the Phillipsburg electric light plant and will build nine miles of No. 9 galvanized wire line for transmitting energy at 13,200 volts, three-wire, three-phase. The line will be built of white cedar poles, spaced 40 to the mile. A pole type transformer substation will be built, using three 10-kilowatt transformers and multi-phase meter. The street lighting system will include 22 series lamps with transformer, meter and time clock. They will be suspended by cable over the center of the streets. The distributing system will cost about $2,000 and will include three 7½-kilowatt 2,300 220-110 transformers and one 2-kilowatt transformer. About 75 buildings will be wired and the meters purchased by the city. The engineering work is in charge of Charles F. Sturtevant, Holdrege, Neb., and the purchasing will be done by a committee appointed by the city in charge of Ira C. Young, Mayor. Complete bills of material will be made out and sealed bids will be received from those wishing to bid on the same.

MANKATO, KANS.—It is reported that the Concordia Electric Light Company has been purchased by an eastern company and that the new owners will take charge this month.

McFARLAND, KANS.—The Alma Light Company has been granted a franchise by the City Council to install an electric light system here.

TOPEKA, KANS.—The contract for rebuilding the east wing of the state house and flood-lighting the dome will be let in the near future by the state executive council.

KEARNEY, NEB.—On June 19 voters here will consider a proposition to grant a 25-year franchise to the L. E. Myers Company, of Chicago, which recently took over the Carnie Water & Electric Power Company. The new franchise will involve the installation of improvements to the street-lighting system.

MILBANK, S. D.—Sealed bids will be received June 4 for furnishing and installing the filter equipment for a mechanical gravity filter plant of 500,000 gallons daily capacity and also for furnishing and installing a motor-driven centrifugal pump with a capacity of 300 gallons per minute, all to be in accordance with plans on file in the office of S. A. Blomquist, city clerk.

FORBES, N. D.—Citizens here contemplate the installation of an electric lighting plant. A transmission line will be built from Ellendale to Forbes.

ROLLETTE, N. D.—The Wolf Creek Telephone Company has been incorporated and plans to build a ten-mile line to cost $1,200 A. S. Myhre, manager.

SOUTH CENTRAL STATES.

ARLINGTON, TENN.—The city will construct an electric plant, the generating units to be oil-engine-driven.

McGEHEE, ARK.—The McGehee Water & Light Company is installing its second 120-horsepower Diesel oil engine and is erecting a new addition to the power house.

OZARK, ARK.—The Citizens' Service Light Company has petitioned the council for a 50-year franchise. The present franchise will expire in seven years.

ADA, OKLA.—Work has been started on the big electric plant of the Oklahoma Power & Light Company, located five miles north of Ada. About $3,000,000 will be expended on the work.

BILLINGS, OKLA.—The city has voted $10,000 bonds to pay for improvements to the municipal electric lighting plant.

CLINTON, OKLA.—Provisions are being made for the installation of the white-way system and the placing of wires underground in Frisco Avenue.

DURANT, OKLA.—The Pioneer Telephone Company is planning on spending $35,000 in improving its equipment, and will install a new switchboard having a capacity of 4,000 phones.

OKLAHOMA CITY, OKLA.—The council is in favor of a white-way system on North Broadway. Address J. C. Walton, commissioner of public works.

OKLAHOMA CITY, OKLA.—The white way has been extended on West Main Street from Harvey to Hudson Avenue and the extension from Grand Avenue to Fourth and Broadway was discussed, but no definite decision was reached.

TULSA, OKLA.—Plans are under consideration for the construction of an electric railway from Tulsa, south to Okmulgee, Okla., about ... miles to be part of a line from Muskogee to Oklahoma City, 125 miles. R. D. Long, of Muskogee, manager of the Muskogee Electric Traction Company, is interested.

TULSA, OKLA.—The City Commissioners have adopted an elaborate white-way plan. The lights will be installed four to the block over an area of several miles at once.

TULSA, OKLA.—The city officials have approved a new ten-year contract with the Oklahoma Public Service Corporation for the installation of white-way light and other street illumination.

WELLSTON, OKLA.—The Spring Valley Rural Telephone Company has been chartered with the following directors: G. W. Spence, Milton Reed and J. H. Green.

BEAUMONT, TEX.—The City Council has ordered an election for July 10 to enable the voters to pass upon the proposed consolidation of the Jefferson

DATES AHEAD.

Electric Power Club. Spring meeting. Homestead Hotel, Hot Springs, Va., June 11-14. Secretary C. H. Roth, 1410 West Adams Street, Chicago, Ill.

Electrical Contractors' Association of Pennsylvania. Annual convention, Philadelphia, Pa., June 19-21. Secretary, M. J. Sellers, 1518 Sansom Street, Philadelphia, Pa.

American Institute of Chemical Engineers. Semi-annual meeting, Buffalo, N. Y., June 20-22. Secretary, J. C. Olsen, Cooper Union, New York City.

American Institute of Electrical Engineers. Annual meeting, New York, N. Y., June 27-28. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

National Electrical Credit Association, annual meeting, Boston City Club, Boston, Mass., June 28-29. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago, Ill.

Ohio Electric Light Association. Annual convention, Breakers Hotel, Cedar Point, O., July 16-20. Secretary, D. L. Gaskill, Greenville, O.

County Traction Company, the Beaumont Traction Company and the Beaumont Electric Light & Power Company. All three of these concerns are owned by the Stone & Webster Engineering Corporation of Boston, Mass. It is planned that the Jefferson County Traction Company, which operates an interurban railway between Beaumont and Port Arthur, a distance of 20 miles, will take over the other two local companies as well as the property of the Port Arthur Light Company. If the consolidation is authorized, important improvements and additions will be made to the merged interests.

SAN ANGELO, TEX.—The Texas Electric & Power Company is planning on the extension of the transmission line from Miles to Paint Rock, a distance of 17 miles.

SWEETWATER, TEX.—The City Commissioners and the Commissioners Court are going to erect a white way around the court-house lawn.

WESTERN STATES.

KALISPEL, MONT.—Application has been made by the Northern Idaho & Montana Power Company for a 50-year light and power franchise in the town of Ronan.

LIVINGSTON, MONT.—An electric lighting system is to be installed at a cost of $8,900. A total of 115 standards will be installed to replace 41 arc lamps now in the business district.

DIXON, WYO.—H. D. McSwam, manager of the new flour mill, will arrange to furnish electricity for street lighting.

ALBUQUERQUE, N. M.—The Albuquerque Gas & Electric Company has been chartered with a capital stock of $500,000.

DEMING, N. M.—W. E. Holt has been appointed chairman of the committee to find out if it is possible to secure electricity in the Mimbres valley from the Elephant Butte dam.

PARKER, ARIZ.—The Western Telephone Company is installing a new system in this city.

PARKER, ARIZ.—A plant is being installed to generate power for lighting the new Commercial Hotel.

TEMPE, ARIZ.—Articles of incorporation have been filed for the Power, Light & Operating Company, with a capital stock of $1,000,000, by E. H. Winkler, William F. Ballard, Charles E. Ballard and J. E. Stringham, all of Oklahoma City, Okla. Phoenix is to be the principal place of business in the state of Arizona.

TOMBSTONE, ARIZ.—The Mountain States Telephone & Telegraph Company has torn down the old building on a site at Fourth and Allen Streets and is erecting a small garage thereon, although it is expected that will be replaced in the near future by a new exchange building.

WICKENBURG, ARIZ. — Preparations are under way for the installation of an electric lighting system here.

YUMA, ARIZ.—Plans are under consideration here for the city to take over the old light and water plant, which is valued at $160,000 by the city engineer.

SALT LAKE CITY, UTAH.—After checking up the power possibilities for the Queen of Sheba mine in the Deep Creek country, Superintendent W. G. Locke thinks there is an opportunity to develop more than 1,000 horsepower.

NAMPA, IDAHO.—A contract was recently signed between Deming Mines Company and the Idaho Power Company for the delivery of 500 horsepower of electrical energy at the mine for operation of a reduction plant. A 15-mile high-tension power line will be erected at once.

BELLINGHAM, WASH.—Work will begin at once on the repair of the Alaska Building. The contract calls for the installation of a new electrical system.

SEATTLE, WASH.—C. E. Doly, general purchasing agent for the Alaskan Engineering Commission, has been taking bids for miscellaneous electrical supplies and materials.

SEATTLE, WASH.—The American Nitrogen Products Company, Securities Building, Seattle, has begun surveys for its proposed power plant and nitrogen products plant on the Sauk-Suiattle River. The power plant is estimated to cost $1,000,000.

SEATTLE, WASH.—The Puget Sound Traction Light & Power Company plans the construction of a frame substation at First South and Spokane Streets. It will contain a 500-kilowatt motor-generator set and provision will be made for the installation of another unit of the same size. The building and equipment will cost $12,000.

WALLA WALLA, WASH.—The County Commissioners have granted a 50-year franchise to the Pacific Power & Light Company to construct and operate electric, telephone and telegraph wires along certain roads in Walla Walla County.

ASTORIA, ORE.—The Port of Astoria Commission is preparing to construct its own power plant for the operation of the machinery at the port elevator and coal bunkers.

PENDLETON, ORE.—According to the management of the local telephone office, a new toll line is soon to be constructed from here to the Washington State line at a cost of $9,950. This will include the stringing of over seven miles of No. 10 iron wire.

BAKERSFIELD, CAL.—The County Supervisors will receive bids up to June 5 for the construction and maintenance of an electric lighting pole line in the Wasco lighting district.

COLUSA, CAL.—The Pacific Gas & Electric Company has been awarded the contract for furnishing light to this city for a term of three years. New lights are to be installed in various sections.

LONG BEACH, CAL.—The Pacific Telephone & Telegraph Company has applied to the State Railroad Commission for approval of a franchise to operate in this city. The company has been doing a telephone business in Long Beach for a number of years, and has 1,614 subscribers, but has been operating without a formal privilege until now.

LOS ANGELES, CAL.—The City Council has adopted a resolution determining that public interest and necessity demands the acquisition and construction of a works for supplying the city with electrical energy for the purpose of light, heat and power, and that the cost thereof is and will be too great to be paid out of the ordinary income of the city. The estimated cost of the proposed improvement is $2,000,000.

MARTINEZ, CAL.—Work is nearing completion on the power lines which the Great Western Power Company is constructing from Moraga Valley via Lafayette, Happy Valley and Briones to Crockett, where it will connect with the company's high-tension lines from Antioch and Napa.

OROVILLE, CAL.—The Great Western Power Company expects to start construction work within six weeks on a dam near the junction of the North Fork and West branch. Specifications for the power plant have already been completed.

PORTERVILLE, CAL.—The Mt. Whitney Power Company is making preliminary surveys for the construction of a new power plant near here.

RIVERSIDE, CAL.—The City Council is taking bids for the installation of a lighting system on Main Street, between Tenth and Fourteenth Streets.

SAN FRANCISCO, CAL.—Bids for city lighting will be received by the Board of Supervisors up to June 14.

SAN FRANCISCO, CAL.—The Alysworth Agencies Company has sold its electrical supplies business at 135 Montgomery Street to Bittman & Battee.

VALLEJO, CAL.—The contract for installing the lighting system in the new Masonic Temple here has been awarded to the Vallejo Electric Light & Power Company at $3,290.

VENTURA, CAL.—Among the extensive improvements being made by the Pacific Telephone Company is the reconstruction of its line between Ventura and Los Angeles which will involve an expenditure of about $96,000.

VENTURA, CAL.—The Oak Ridge Oil Company has been granted a franchise for a telephone system upon certain public highways in Ventura County.

INCORPORATIONS

NEWTON, N. J.—The Hardyston Electric Company and Hardyston Water Company. Capital, $100,000; to operate local electric and water properties. Incorporators: Thomas W. Waters, Haddon Heights, N. J.; Edgar S. Waters, National Park, N. J., and Charles S. Rindsfoos, Upper Montclair, N. J.

NEW YORK, N. Y.—Holloway, Bentz & Company. To operate an electrical contracting business, etc. Incorporators: C. B. and R. C. Bentz and W. A. Van Ness, 220 Broadway, New York.

SYRACUSE, N. Y.—The Syracuse Northern Electric Railway, Inc. Capital, $1,250,000. To operate local electric lines. Incorporators: C. L. Allen, T. C. Cherry and A. H. Cowie, Syracuse.

PHILADELPHIA, PA.—Keystone Electrical Appliance Company, with Delaware charter, and nominal capital of $5,000. To manufacture switches and other electrical specialties. Incorporators: Stephen D. Large, C. C. Davis and Horace S. Jones, all of Philadelphia.

DOVER, DEL.—The Powerlight Company. Capital, $500,000. To manufacture lamps and illuminating specialties. Incorporators: Samuel B. Howard, Arthur W. Britton and Louis H. Gunther, New York.

DOVER, DEL.—Politowski Magnetic Engine Company. Capital, $1,000,000. To manufacture electrical machinery. Incorporators: A. N. Jarvis and Samuel McK. Dane, Chicago.

SALT LAKE CITY, UTAH.—Electronite Manufacturing Company. Capital, $1,000,000. Manufacture electric heating appliances, such as electric pads, etc. Incorporators: L. C. Hornschurch, H. L. Bliss, Robert Huxby and C. A. Elliott.

MEMPHIS, TENN.—Storage Battery & Sales Company. Capital, $5,000. Incorporators: W. H. Daniel, W. P. Metcalf, Roger Stanly, Lake Hays and I. M. Craig.

QUINCY, ILL.—The Electric Service Company. Capital, $2,500. Incorporators: Abbot Merrylees, M. J. Dickman and others.

LITTLE ROCK, ARK.—Arkansas Prepay Fan Company. Deal in electric fans and other electrical appliances. Incorporators: E. T. Reeves, H. D. Hart and Gus Bertner.

HOUSTON, TEX.—Houston Storage Battery Company. Capital, $2,500. Incorporators: E. S. Van Dyke, M. I. Keller and C. B. Clayton.

PROPOSALS

LIGHTING SYSTEM.—Contracts will be awarded August 1, for waterworks, electric lights and sewers at Billings, Okla. Address Mackintosh-Walton Engineering Company, 1023 National Bank Building, Oklahoma City, Okla.

ELECTRICAL WORK.—The Board of Education of Bayonne, N. J., will receive bids on June 14 for electrical work in the new school to be erected on Avenue B, in connection with bids for general construction. D. G. Anderson, Avenue E and Thirtieth Street, is architect.

ENGINE AND GENERATOR.—Sealed bids will be received at Marshall, Minn., June 4, for furnishing one new 150 or 200-horsepower engine or turbine direct-connected to an engine-type generator. Generator to be 125 or 150 kilowatts, 60-cycle, 2,300-volt, three-phase, belted to a direct-current exciter large enough to furnish sufficient current for the alternator. Address A. G. Bumford, city recorder.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 1182, Washington, D. C., 400 high resistance and unadjustable type, radio head receivers, with cord. Schedule 1184, Washington, D. C., electrical equipment consisting of rammers, powder hoists, shell hoists, etc. Schedule 1186, Philadelphia, Pa., and Norfolk, Va., furnishing and installing complete furnaces and blowers. Bidders desiring to submit proposals should make application to the bureau or to the nearest navy yard purchasing office.

ELECTRICAL WORK.—Bids will be received at the office of the depot quartermaster, El Paso, Tex., until June 14, for alterations in construction and new electrical and pumping equipment at present pumping station.

GENERATING UNIT.—Sealed bids will be received at the City Recorder's, Mar-

shall, Minn., until June 4, for furnishing one new 150 or 200-horsepower engine or turbine direct-connected to an engine-type generator, the latter to be 125 or 150-kilowatt, 60-cycle, 2,300-volt, three-phase, belted to a direct-current exciter. All bids and plans to conform to and agree with specifications on file in the office of A. G. Bumford, City Recorder.

ELECTRICAL EQUIPMENT.—Bids will be received at the office of the City Clerk, Batavia, Ill., until June 11 for the furnishing municipal plant equipment and machinery as noted in the following propositions: Proposition No. 1, one compound engine, 500-horsepower, 100 to 125 pounds steam pressure; proposition No. 2, one 300-kilowatt, 1,150-volt, three-phase, 60-cycle rotating-field engine-type generator; proposition No. 3, one 300-kilowatt turbogenerator unit, turbine to operate on 125 pound steam pressure, no superheat and five pounds back pressure, generator to be 300 kilowatts at 80 per cent power factor, 1,150 volts; proposition No. 4, one automatic voltage regulator to operate on present 12-kilowatt, 125-volt unit and the proposed unit. Specifications can be had on application to W. H. Reaney, city clerk.

FINANCIAL NOTES

The Montana Power Company has declared a quarterly dividend of 1.25 per cent on the common stock, and the regular quarterly dividend of 1.75 per cent on the preferred, both payable July 2 to stock of record June 15. This places the common stock on a five-per-cent annual basis compared with four-per-cent here tofore.

Stockholders of Havana Electric Railway, Light & Power Company have approved the plan to increase the preferred capitalization from $15,000,000 to $21,000,000. Common and preferred holders of record March 28 have the privilege to subscribe to the new stock, on the basis of 20 per cent of their holdings, at par ($100) and an amount equivalent to the accruing dividend thereon to June 15, making a total of $101.25 per share for the new preferred. Payment for the stock must be made on or before June 15. The annual report of the company for year ended December 31, 1916, compares as follows:

	1916.	1915.
Gross earnings	$6,017,708	$5,541,303
Net after taxes	2,276,731	2,088,383
Surplus after dividends	624,391	514,095

Gross income of the Consolidated Gas, Electric Light & Power Company of Baltimore for the ten months ended April 30 were $7,065,575, an increase of $859,169 or 13.8 per cent over the same period of the previous fiscal year. Operating expenses and taxes showed an increase of $532,447, or 16.7 per cent, while net earnings were $3,353,221, an increase of $526,721, or 10.8 per cent over the same months of the previous year. Fixed charges showed but a small increase, 1.8 per cent, leaving surplus after charges at $1,996,362, an increase of $302,850, or 17.9 per cent over the same ten months of the previous year. This surplus showed the best per-cent gain of all the items. The new business department of the company still reports favorable increases in customers, April showing a net gain of 950 gas and electric consumers and gross sales of gas and electric appliances amounting to $156,135. For the ten months ended with April there was a net increase of 10,223 gas and electric consumers, while the gross sales of gas and electric appliances for the period amounted to $1,247,589.

The Western Carolina Power Company of Charlotte, U. S., has filed an amendment to its charter increasing its capital stock from $300,000 to $4,500,000. The company is a subsidiary of the Southern Power Company.

Gross earnings of $89,539,412, with a net manufacturing profit of $17,461,690 and net income available for dividends and other purposes of $18,079,889, are reported by the Westinghouse Electric & Manufacturing Company for the fiscal year ended March 31 last.

The gross earnings and net incomes for the year are greatly in excess of any previous year in the company's history. Completion of large orders for munitions contributed, says the report, largely to the results, although sales billed and net incomes from the regular products of the company show large gains over any preceding year.

The value of unfilled orders on March 31 last, for the regular products of the company was $39,776,739 as compared with $22,097,995 on the corresponding date of last year.

Assets include cash amounting to $12,476,380, against $8,184,941 in 1916, and accounts receivable total $32,757,632, against $9,811,217. The company's total assets were increased from $82,432,946 in 1916 to $127,542,811.

Regarding orders for war munitions, Chairman Guy E. Tripp says:

"With the exception of the contracts with the British government for the manufacture of Russian military rifles which are being carried out by the New England Westinghouse Company upon a modified contract herein before referred to, the company has no uncompleted munitions contracts for foreign governments on its books, all such contracts having been completed or cancelled."

Officials and department heads of Thomas A. Edison, Inc., West Orange, N. J., have subscribed a total of $30,750 to the Liberty Bond fund in connection with an informal dinner, May 24.

The General Electric Company, Schenectady, N. Y., has authorized the purchase of $5,000,000 of Liberty Loan bonds. The company has also arranged to purchase the amount of bonds subscribed by employes, allowing time payments from the workers.

The Penn Central Light & Power Company, Altoona, Pa., is arranging to purchase the Liberty Bond fund subscribed to by employees, with distribution to the men on the easy-payment plan.

Reports of Earnings.

BROOKLYN EDISON.

The Edison Electric Illuminating Company of Brooklyn reports for the years ending December 31, 1915, and 1916, as follows:

Gross revenue	$8,130,199	$6,928,115
Net after taxes	3,116,149	2,358,584
Total income	3,143,991	2,384,566
Charges	681,315	675,836
Contingency reserve	569,175	.....
Adjustments—debit	93,473	†82,324
Rent of electric plant	1,800,028	1,791,054

†Credit.

KINGS COUNTY LIGHTING.

The Kings County Lighting Company reports for the years ending December 31, 1915, and 1916, as follows:

Gross revenue	$950,363	$890,702
Net after taxes	221,339	270,342
Surplus after charges	45,404	101,754
Previous surplus	626,152	645,300
Sundry adjustments	170	902
Dividends	20,000	120,000
Surplus	651,385	626,151

ARIZONA POWER.

Comparative statement of earnings and expenses is as follows:

Month of February:	1917.	1916.
Gross earnings	$32,173.76	$18,148.14
Operating expenses and taxes	9,126.09	7,046.32
Net earnings	23,047.67	11,101.82
Other income	15.25	15.00
Total income	23,062.92	11,116.82
Bond interest	9,240.00	9,250.00
Note interest	1,333.33	.....
General interest	530.00	17.00
Depreciation reserve	1,608.68	907.40
Net income	10,350.91	942.42
Operating ratio	28.4%	38.8%

Twelve months ended February 28:	1917.	1916.
Gross earnings	$342,404.66	$229,270.25
Operating expenses and taxes	110,257.93	70,527.40
Net earnings	232,146.73	158,742.85
Other income	219.18	325.85
Total income	232,365.91	159,068.70
Bond interest	110,881.67	111,000.00
Note interest	10,666.66	.....
General interest	7,986.31	158.69
Depreciation reserve	17,133.17	11,463.43
Net income	85,698.10	36,446.58
Operating ratio	32.2%	30.8%

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRIC COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate per cent.	Bid May 21.	Bid May 28.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	..	20	20
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	125	123
American Gas & Electric of New York, preferred	6	49	49
American Light & Traction of New York, common	..	307	318
American Light & Traction of New York, preferred	6	110	110½
American Power & Light of New York, common	4	68	67
American Power & Light of New York, preferred	6	89	89
American Public Utilities of Grand Rapids, common	..	30	30
American Public Utilities of Grand Rapids, preferred	6	64	63
American Telephone & Telegraph of New York	..	120½	122¼
American Water Works & Elec. of New York, common	..	6½	7
American Water Works & Elec. of New York, particip.	7	25	22
American Water Works & Elec. of New York, first preferred	..	76½	76
Appalachian Power of Bluefield, common	..	5	5
Appalachian Power of Bluefield, preferred	7	33	30
City Service of New York, common	6+extra	285	289
City Service of New York, preferred	6	85	86
Commonwealth Edison of Chicago	8	125	121
Comm. Power, Railway & Light of Jackson, common	4	49	49
Comm. Power, Railway & Light of Jackson, preferred	6	74	74
Federal Light & Traction of New York, common	..	11	11
Federal Light & Traction of New York, preferred	..	43	43
Illinois Northern Utilities of Dixon	6	78	78
Middle West Utilities of Chicago, common	2+2 extra	42	43
Middle West Utilities of Chicago, preferred	6	68	68
Northern States Power of Chicago, common	7	88	89½
Northern States Power of Chicago, preferred	7	97	98
Pacific Gas & Electric of San Francisco, common	5	55¾	56
Pacific Gas & Electric of San Francisco, preferred	6	88	89
Public Service of Northern Illinois, Chicago, common	7	90	93
Public Service of Northern Illinois, Chicago, preferred	6	95	96
Republic Railway & Light of Youngstown common	4	29	30½
Republic Railway & Light of Youngstown, preferred	6	64	65¼
Standard Gas & Electric of Chicago, common	..	10	10½
Standard Gas & Electric of Chicago, preferred	6	35	36
Tennessee Railway, Light & Power of Chattanooga, common	..	5¼	5½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	24½	25
United Light & Railways of Grand Rapids, common	4	39	39
United Light & Railways of Grand Rapids, preferred	6	68	69½
Western Power of San Francisco, common	..	13	15
Western Power of San Francisco, preferred	6	51	48
Western Union Telegraph of New York	5+extra	92	93
Industrials—			
Electric Storage Battery of Philadelphia, common	4	60	62
General Electric of Schenectady	8	159½	162
National Carbon of Cleveland, common	8	*75	*75¾
National Carbon of Cleveland, preferred	7	*133	*133
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	54⅜	54⅜
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	67	67

*Last sale.

Electrical Patents Issued May 22, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,226,627. **Resistance Unit.** T. E. Barnum, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Has special mounting of thin, flexible, reflexed resistor strip.

1,226,635. **Electromagnet Vibrator.** F. E. Brixius, assignor to Manitowoc Electric Implement Co., Manitowoc, Wis. For masses, etc.; has electromagnet spring mounted on a magnetic plate.

1,226,639. **Electric Welding.** S. C. Cary, Brooklyn, N. Y. Machine for welding continuous seam between overlapping edges of sheets.

1,226,651. **Melting-Pot Feeder.** G. L. Fort, assignor to Fort-ified Mfg. Co., Kansas City, Mo. Electrically heated container for feeding pot has temperature controlled according to level of metal in pot.

1,226,658. **Distributing Mechanism for Electrical Ignition System.** O. Heins and V. W. Kliesrath, assignors to Bosch Magneto Co., New York, N. Y. Detailed arrangement of distributers with grounded spark plugs.

1,226,666. **Magneto-Electric Machine.** F. R. Hoyt, assignor to Simms Magneto Co. Structural details of device having special pole face structure with regard to advanced and retarded spark.

1,226,667. **Electromagnetic Element or Structure.** M. A. Hunter, Troy, N. Y. Material of high permeability and low hysteresis, comprising titanium, treated iron and carbon.

1,226,696. **Thermostat-Operated Circuit.** W. A. Ramseur, Gainesville, Ga. Controls reversible motor for actuating switches.

1,226,697. **Solenoid for Driving Adding-Machines.** F. C. Rinsche, assignor to Burroughs Adding Machine Co., Detroit, Mich. Structural details.

1,226,717. **Lighting-Fixture.** M. P. Stevens, East Orange, N. J. Arrangement of socket support, canopy and shade holder.

1,226,727 and 1,226,728. **Pocket Flash-Light.** C. Wachtel, Jamaica, N. Y. First patent: body has hinged cover interlocked with switch to prevent opening while lamp is lighted and while switch is being operated. Second patent: details of usual tubular type.

1,226,732. **Projectile.** C. W. White, Chicago, Ill. Explosive gases are generated from water by electrolysis.

1,226,733. **Lamp-Container.** H. E. Whitney, assignor to Dover Stamping & Mfg. Co., Portland, Me. A rigid tube with socket in cover at each end.

1,226,734. **Electric-Fan Attachment.** W. I. Work, assignor to Walworth Mfg. Co., Boston, Mass. Electric heater mounted on fan guard.

1,226,748. **Solenoid.** G. A. Burnham, assignor to S. B. Condit, Jr., Brookline, Mass. Alternating current structure, comprising sound-deadening material.

1,226,751. **Engine-Starting System.** W. A. Chryst, assignor to Davton Engineering Laboratories Co. Gearing and mounting of motor-generator in relation to engine.

1,226,764. **Electric Induction-Furnace.** J. Funck, assignor to Grondal, Kjellin Co., Ltd., London, England. Method of lining hearths.

1,226,775. **Telegraph-Sounder.** R. Koenig, Newburg, Wis. Structural details.

1,226,780. **Multiple Refillable Fuse.** F. J. Cleaver, Carnegie Borough, Pa., assignor of one-third to S. L. H. Morris and one-third to H. W. Hodgdon, Pittsburgh, Pa. Structural details.

1,226,792. **Train-Control System.** A. Minnick, Newark, N. J. Block signal and control system wherein the track circuit is grounded by the rolling stock.

1,226,795. **Insulator-Press.** W. Newby, assignor to W. I. Lourie, Youngstown, O. Structure of mechanism for molding insulation.

1,226,808. **Sealable Fuse-Plug.** C. D. Platt, Bridgeport, Conn. The transparent disk is secured in place by a metal cap having an eyelet through which a sealing strand passes.

1,226,811. **Process of Securing Potassium Cyanid from Water-Insoluable Potassium-Containing Mineral.** J. H. Reid, Newark, N. J. Employs electric current to induce reaction in the production of potassium cyanid from feldspar.

1,226,812. **Process of Securing Water-Soluble Potassium Compounds from Water Insoluble Potassium-Containing Mineral.** J. H. Reid, Newark, N. J. Modification of above.

1,226,813. **Electric-Wiring Connection.** H. Rountree, Kenilworth, Ill. Device for extending about edge of molding and establishing connection with switches hidden thereby.

1,226,816. **Primary Battery.** C. B. Schoenmehl and M. L. Martus, assignors to Waterbury Battery Co., Waterbury, Conn. Structure of element of assembled element form of battery.

1,226,817. **Distributing Mechanism for Electrical Ignition Systems.** W. E. Schwarzmann, assignor to Bosch Magneto Co. Detailed arrangements.

1,226,826. **Direction Signal for Motor Vehicles.** K. E. Stoker, Stockton, Cal. Details of device having electrically operated and illuminated arm.

1,226,835. **Electrical Toy.** A. B. Wilder, assignor to Wilder Patents Co., St. Louis, Mo. Arrangement of motor and circuit for swinging a figure as a parrot on a perch.

1,226,837. **Variable-Resistance Unit.** B. F. Willston, Detroit, Mich., assignor of one-half to R. E. Green, Detroit, Mich. Insulating knob secured by central screw has special arrangement of terminals and resistor wound on it.

1,226,849. **Electric Water-Heater.** J. B. Bookman, Manhattan, Nev. Arrangement of valves and circulating passages.

1,226,882. **Gyro-Compass.** J. B. Henderson, Lee, England. The suspension for the sensitive element consists of

1,226,921.—Connection for Electric Conduit.

filars electrically insulated from each other.

1,226,886. **Telephone-Transmitter.** N. H. Holland, assignor to New Jersey Patent Co., West Orange, N. J. Microphone has one electrode movable by sound vibrations and other supported by pneumatic dashpot.

1,226,901. **Synchronous Dynamo-Electric Machine.** S. H. Martin, Chicago, Ill. Has a magnetic yoke and polar projections with an annular magnetic screen at the inner ends thereof carrying damping and supplementary magnetizing windings.

1,226,915. **Automatic Train-Stop.** H. G. Sedgwick, assignor to National Safety Appliance Co. Details of electromagnetic control of vent valve for train pipe of brake system.

1,226,916. **Train-Control Apparatus.** H. G. Sedgwick, assignor to National Safety Appliance Co. Road bed block system for railway signaling and stopping.

1,226,921. **Connection for Electric Conduits.** G. L. Stewart, assignor to Crouse-Hinds Co., Syracuse, N. Y. Special structure for forming a tight joint with a gasket.

1,226,925. **Ductile Filament.** O. M. Thowless, assignor of one-half to A. J. Thowless, Newark, N. J. Method of making; flashed refractory metal and powdered refractory metal are united to form a mixture in a solid body which is worked to a fibrous structure and reduced to filamentary diameter.

1,226,926. **Electric Flash-Light.** J. Iscione, New York, N. Y. Switch and casing structure of tubular device.

1,226,940. **Fuel-Supplying Device for Internal-Combustion Engines.** W. K. Bassford, assignor to Universal Oil Converter Co., Long Island City, N. Y. Fuels of different specific gravities are heated in passage to engine and the feed of the fuels is electromagnetically controlled responsive to the temperature of the heated fuel.

1,226,946. **Speedometer.** A. A. Canton, N. Y. Magnetic arrangement responsive to frequency of impulses varying with the speed.

1,226,947. **Terminal Bank.** H. P. Clausen, assignor to Western Electric Co., New York, N. Y. Arrangement and structure of flat terminal strips to form a contact bank for use in telephone apparatus.

1,226,953. **Calling Device.** A. H. Dyson, assignor to Western Electric Co. Impulse transmitter for telephone systems.

1,226,956. **Mercury Motor-Meter.** A. L. Emens, assignor to Sangamo Electric Co., Springfield, Ill. Special structure of cover for mercury chamber where armature shaft passes through.

1,226,966. **Telephone System and Apparatus.** C. L. Goodrum, assignor to Western Electric Co. Structure of automatic telephone exchange switch.

1,226,971. **Combined Starting and Ignition Switching Device and Circuits Therefor.** W. J. Hart, assignor to Splitdorf Electrical Co., Newark, N. J. Ignition circuit is controlled by the connection of the starting motor with battery.

1,226,972. **Auxiliary Starting Device for Internal-Combustion Engines.** W. J. Hart, assignor to Splitdorf Electrical Co. Operation of starting switch actuates compressor to force air and fuel into intake manifold.

1,226,981. **Telephone-Call-Registering System.** A. E. Lundell and H. G. Eddy, assignors to Western Electric Co. Call register is controlled by listening-in and listening-out mechanism.

1,226,982. **Adjustable Interrupter for Ignition Dynamos.** C. T. Mason, assignor to Splitdorf Electrical Co. Manner of mounting on generator.

1,227,003. **Engine-Starter.** J. H. Richards, assignor to Splitdorf Electrical Co. Gearing of motor to engine.

1,227,006. **Electrically Controlled Mechanism.** L. Seese, Navarre, and J. F. McGuire, Massillon, Ohio. Power and brake of a railway car are electrically controlled on passing a semaphore arm.

1,227,010. **Telephone-Exchange System.** E. H. Smythe, assignor to Western Electric Co. Details of cord circuit.

1,227,012. **Flash-Light.** M. H. Spielman, New York, N. Y., assignor of one-half to J. Corcos, Brooklyn, N. Y. Details of structure of tubular type.

1,227,013. **Flash-Light or Electric Torch.** M. H. Spielman, assignor of one-half to J. Corcos. Modification of above.

1,227,021. **Actuating Signals on and Communicating with Trains.** H. A. Thompson, Withington, Manchester, England. Inductive signaling or control system comprising a polarized reed relay.

1,227,027. **Heat-Treating Furnace.** T. F. Baily and F. T. Cope, assignors to Electric Furnace Co., Alliance, Ohio. Movement of material through furnace is electro-thermally controlled according to the temperature of the furnace.

1,227,028. **Insulated Rail-Joint.** C. E. Ballou, Roanoke, Va. Structural details.

1,227,030. **Hand-Audiphone.** F. A. Barber, assignor to Globe Ear-Phone Co., Boston, Mass. Structure of portable telephone.

1,227,038. **Resistance Unit for Electric Circuits.** W. A. Chryst, assignor to Dayton Engineering Laboratories Co., Dayton, O. Resistor is in a peripheral groove in an insulating disk and has its ends connected with terminal plates on opposite sides of the disk.

1,227,067. **Means for Promoting the Discharge of Molten Products from a Furnace or Other Apparatus.** J. H. Reid, Newark, N. J., assignor to Patents Process Co. Current is passed through the molten metal issuing from the tap hole.

1,227,068. **Furnace or Apparatus for Making Products Electrically and Means for Facilitating Discharge of Same.** J. H. Reid, assignor to Patents Process Co. Comprises electrode arrangement and control whereby products of different volatizing points are obtained in a vessel provided with a condenser and the product is maintained fluid at discharge by an electric arc.

1,227,069. **Furnace or Apparatus for Electrically Making Products and Means**

for Heating Discharging Products. J. H. Reid, assignor to Patents Process Co. Modification of above wherein fluidity at discharge is attained by induction.

1,227,070. Lamp-Controlled Circuits. W. Reid, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Arrangement of key switch controlling battery lamp circuits by telephone system.

1,227,084. Signal. W. Sparks, assignor to Sparks-Withington Co., Jackson, Mich. Motor-operated horn.

1,227,091. Speed-Regulating Apparatus. J. B. Taylor, Schenectady, N. Y. A pair of vibratory elements of different periods are vibrated in response to the motor, speed and vary the motor excitation according to the difference of their amplitudes.

1,227,226. Automobile-Signal. V. Walsh, New York, N. Y. Lamp house has electrically controlled shutters.

1,227,228. Cutout for Electric Sterilizers. W. L. Woerner, assignor to Prometheus Electric Co. Circuit to electric heater is held closed by a fuse.

1,227,230. Electric Pump-Governor. B. S. Aikman, assignor to National Brake & Electric Co., Milwaukee, Wis. Structure of pressure operated switch.

1,227,241. Electrical Appliance. C. H. Bissell & E. G. Smith, assignors to Crouse-Hinds Co., Syracuse, N. Y. Manner of mounting electrical receptacles on a plate.

1,227,256. Multiple-Fuse Plug. F. A. Feldkamp, J. P. Pryor and H. Payson, assignors to Six-in-One Fuse Co., New York, N. Y. Details of construction.

1,227,270. Circuit-Closing Push-Button. R. J. Jackson, assignor of one-half to W. H. Jenkins, Philadelphia, Pa. Structural details.

1,227,285 and 1,227,286. Draft-Indicator. J. Maher, Cleveland, Ohio. First patent: Float moved according to draft of vessel controls signal circuit. Second patent: Modification.

1,227,291. Gyratory Fan. F. H. Miller, assignor to Westinghouse Electric & Mfg. Co. Structure depending from ceiling has motor near point of suspension; is geared through depending pipe and horizontal arms, with fans at ends of arms.

1,227,295. Storage-Battery Electrode or Grid. W. Morrison, Des Moines, Iowa. Has serpentine folded strips mounted in frame.

1,227,302. Means for Controlling Alternating Currents. M. Osnos, assignor to General Electric Co. Inductive device wherein alternating fluxes are opposed by direct current fluxes.

1,227,314. Transformer. E. G. Reed, assignor to Westinghouse Electric & Mfg. Co. Structure of shell type.

1,227,316. Method of Generating and Timing Ignition-Currents. B. P. Remy and F. I. Remy, assignors to Splitdorf Electrical Co. For producing ignition current constant in tension and volume.

1,227,320. Demand Apparatus. L. T. Robinson, assignor to General Electric Co. Details of meter gearing.

1,227,321. Regulator for Dynamo-Electric Machines. P. Rose, assignor to General Electric Co. Vibratory contact field regulator of exciter is controlled by voltages of line and exciter.

1,227,326. Electric Time-Switch. G. E. Schindler, Ashland, Wis. Contact structure of clock-operated device.

1,227,337. Temperature-Measuring Instrument. T. Spooner, assignor to Westinghouse Electric & Mfg. Co. Has a potentiometer operated by thermo-couples.

1,227,341. Electromagnetic Device. H. F. Stratton, assignor to Electric Controller & Mfg. Co., Cleveland, Ohio. Structure of electromagnetically operated contactor.

1,227,346. Method of Making Electrical Conductors. S. Trood and G. Choven, assignors to Westinghouse Electric & Mfg. Co. Insulated conductor is inserted in seamless tube and the latter drawn down onto the insulation.

1,227,367. Latching and Tripping Mechanism. V. S. Beam and E. C. Otto, assignors to Westinghouse Electric & Mfg. Co. Structure of toggle-operated circuit breaker.

1,227,375. Electric Connection for Railway Vehicles. L. Boirault, Paris, F. Automatic coupling of the stud and socket type.

1,227,385. Circuit-Interrupting Means. F. E. Case, assignor to General Electric Co. Fuse has magnetic blow-out with chutes for the arc gases.

1,227,386. Two-Voltage Circuit-Breaker. F. E. Case, assignor to General Electric Co. For line operating on high and low voltages; breaker has trip adjusted according to voltage.

1,227,400. Electric Motor. M. D. D. Browolsky, assignor to General Electric Co. Motor speed is rendered independent of voltage changes by a special short-circuited winding on armature.

1,227,403. Coin-Collecting Apparatus. H. A. Drew, West New York, and G. M. Mazza, Weehawken, N. J., assignors to Coin Device and Signal Co., Inc. Registers are electrosponsively controlled.

1,227,404. Expansion Chamber for Electrical Apparatus. D. DuBois, assignor to General Electric Co. Oil-immersed transformer has bag in top of casing with its interior communicating with atmosphere.

1,227,413. System of Control. R. E. Ferris, assignor to Westinghouse Electric & Mfg. Co. Regulation for constant low voltage of a dynamo driven by a number of motors mechanically connected to a load and receiving energy from high-potential supply.

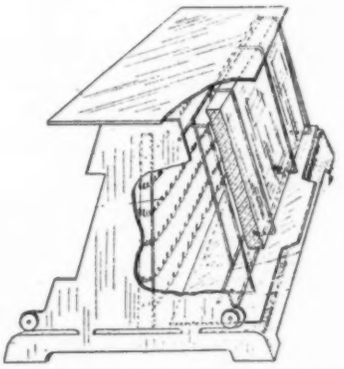
1,227,414. Dynamo-Electric Machine. A. B. Field, assignor to Westinghouse Electric & Mfg. Co. Structure of coil-retaining wedge.

1,227,415. Transformer. C. LeG. Fortescue, assignor to Westinghouse Electric & Mfg. Co. Three-phase, T-connected structure.

1,227,416 and 1,227 417. Circuit-Interrupting Device. C. LeG. Fortescue, assignor to Westinghouse Electric & Mfg. Co. First patent: Mercury-vapor device has arc extinguished by oscillating voltage on overload. Second patent: Modification.

1,227,433. Relay. M. Hartenheim, assignor to Westinghouse Electric & Mfg. Co. Contacts are operated by two thermal-responsive devices of different thermal inertia.

1,227,434. Switching Device. S. Q. Hayes and C. McL. Moss, assignors to



1,227,488.—Electric Toaster With Mirror.

Westinghouse Electric & Mfg. Co. Circuit breaker with pillar type disconnecting switches has both poles grounded when disconnected.

1,227,441. Illumination Device for Use on Air-Craft. H. E. S. Holt, Farnborough, England. For facilitating landing at night; has Bengal light-cylinders with electrically controlled fuse.

1,227,443. Process of Making Caustic Soda. H. B. Kipper, Solvay, N. Y. Electrolytic method of purifying solutions of metallic impurities.

1,227,462. No-Glare Device. M. Lucklesh, assignor to General Electric Co. Structure of reflector for headlights.

1,227,468. Electrical Measuring Instrument. P. MacGahan, assignor to Westinghouse Electric & Mfg. Co. Special arrangement of non-magnetic housing in indicating instrument.

1,227,469. Relay. P. MacGahan, assignor to Westinghouse Electric & Mfg. Co. Time relay operating circuit-breaker after different times according to load.

1,227,470. Spark-Plug. O. B. Mack, assignor to All-Weather Spark Plug Co., Des Moines, Iowa. Structural details.

1,227,472. Circuit-Interrupter. J. N. Mahoney, assignor to Westinghouse Electric & Mfg. Co. Details of switchboard circuit-breaker.

1,227,474. Telephone System. T. G. Martin, assignor to Automatic Electric Co., Chicago, Ill. Automatic.

1,227,476. Apparatus for Re-educating and Improving Hearing. A. Maurice, Paris, France. Structure of telephone receiver and arrangement of circuits and operating switches.

1,227,488. Electric Cooker. S. B. Oakes, Flint, Mich. Toaster has a mirror for observing condition of bread side next heater.

1,227,521. Wireless Telegraph Transmitter. J. G. Balsillie, Melbourne, Victoria, Australia. Special structure and relation of radiator and an exciting circuit containing condensers.

1,227,523. Photographic Time-Announcer. J. G. Blessing, assignor to Automatic Electric Co., Chicago, Ill. In an automatic telephone system.

1,227,529. Radiator-Heater. A. R. Clarke, assignor to Clarke Electric Heater Co., Sheridan, Wyo. Tubular structure for insertion in a fluid passage.

1,227,538. Flexible Electrical Conduit. C. Hyde, assignor to R. Dart, New York, N. Y., and J. T. Monell, Jersey City, N. J. Comprises rings of semi-flexible material interwoven with longitudinal members of flexible material, coating of compound thereon, a jacket of textile fabric and an outer coating of compound.

1,227,552. Ore-Separater. J. S. Morrison, Wallport, Ore. Electromagnet is adjacent one vertical side of a belt, the material being projected against the other side.

1,227,553. Plural Lamp-Socket. A. C. Recker, assignor to Waterbury Mfg. Co., Waterbury, Conn. Structure of plug adapted to receive two lamp bases.

REISSUES.

13,304. Relay and Repeater. W. Finn, assignor to Western Union Telegraph Co., New York, N. Y. For telegraphs; structure of device responsive to reversals of polarity.

Patents Expired.

The following United States electrical patents expired on May 29, 1917:

650,364. Electric-Railway System. A. H. Armstrong, Schenectady, N. Y.

650,370. Apparatus for Starting Motors. W. Cooper, Cincinnati, O.

650,381. Facsimile Telegraph. P. Dun Lany and H. R. Palmer, Cleveland, O.

650,384. Trolley. C. M. Feist, Sioux City, Iowa.

650,416. Knife Switch. C. G. Perkins, Hartford, Conn.

650,417. Portable Storage-Battery Cell and Containing Case Therefor. D. P. Perry, Chicago, Ill.

650,418. Casing and Lamp Socket for Portable Electric Lamps. D. P. Perry, Chicago, Ill.

650,425. Automatic Magnet Circuit-Breaker. W. M. Scott, Philadelphia, Pa.

650,426. Supervisory Signal for Telephone Switchboards. C. E. Scribner, Chicago, Ill.

650,430. Electric-Current or Motive-Force Controller. A. L. Stevens, New York, N. Y.

650,432. Flush Box for Electric Sockets and Plugs. C. H. Stewart, Chicago, Ill.

650,452. System of Train Control for Electric Motors. F. E. Case, Schenectady, N. Y.

650,485, 650,486, 650,487, 650,488 and 650,489. Signal for Telephone Trunk Lines. C. E. Scribner, Chicago, Ill.

650,499. Electric Belt. P. Wenigman, Chicago, Ill.

650,531. Incandescent Lamp. A. Fessenden, Allegheny, Pa.

650,536. Process of Manufacturing Substances Resembling Mannite. Arthur Hough, San Francisco, Cal.

650,548. Telephone-Exchange System. W. Smith, Ridley Park, Pa.

650,550. Electric Cable. M. I. Baird, Glenfield, Pa.

650,551. System of Electrical Distribution. M. I. Baird, Glenfield, Pa.

650,570. Signaling System. L. C. Smith, Torrington, Conn.

650,582. Rheostat Switch. R. Fuller, Detroit, Mich.